Materials of conference

CONCEPTION OF THE EFFECTIVE UTILIZATION OF MEANS OF PRODUCTION IN THE ROAD-BUILDING IN RUSSIA

Ivanov V.N.
The Siberian Automobile and Roadway Academy
Omsk, Russia

The interpretation of the rationality from the point of view of a customer company engaged in building, exploitation and keeping transport constructions, a contractor company and a consumer differ in our time.

The questions of rational nature usage when transport constructions are used by consumers is in the sphere of the economic decisions about the place and the time of their building, about the choice of the type of constructions and the terms of their exploitation.

The same question from the point of view of the customer of building, exploitation and keeping of the transport construction is the question about the optimization of the results of its usage by consumers and expenditures necessary to accomplish the work by constructor companies.

The question of work's optimization of contractor companies touches the choice of the complex organizing and technological decisions; the part of them is the optimization of the means of labor of these companies – system of leading and auxiliary cars and gears.

Let us examine the last problem in detail.

The fulfilled investigation can be structured in the following way.

First we systematized factors influencing the effectiveness of technological and organizing decisions including the usage of cars' park. We determined the place of the cars' park among interdependent systems of different level. On the basis of the factor analyses we described the interdependence between the efficiency of the organizing and technological decisions from one side and the means of mechanization and other resources from the other side. The results of the investigation are showed in the books [13, 14].

Then we made an retrospective analyses of the system of criteria of the estimation of the effectiveness of the usage of cars' systems of building companies. As the result we established the expediency of the usage of the integral criterion of the efficiency that connects in the unity the particular indices. The criterion "Net Present Value" was also substantiated.

For showing analytically the interdependence between the efficiency of technological decisions and the resources being used we elaborated an economic and mathematical model of the choice of effective variants of technological decisions [15]. This model is characterized by the next opportunities: it allows estimating expenditures on the work and the results and conducting them under the time using a single function having a special purpose; it allows examining the organization of building work as a probabilistic system; it allows appreciating the efficiency from the point of view of customer and contractor in some functions having a special purpose [10]; it appreciates adequately the usage of new economical technologies and cars realizing them including future expenditures of the consumer (customer); it provides its large usage in the building (experimentally proved) [9].

After we described the place of the means of mechanization in the efficiency of the building manufacture as a whole we worked out an economic and mathematical model for the calculation of the effective structure of cars' park of the road-building company in modern economic conditions (fir new and for settled structures of cars' parks) [12]. This model is characterized by next peculiarities: the model corresponds to the criterion of the evaluation of the efficiency – the net present value; it takes into account that the cars in the park are interdependent and the whole work takes place in structure of the concrete car and road detachment that determines the productivity and technical and economic indices for each car; it has a possibility for tenant operations for machines, their reservation, the financial calculation of work's results; it allows evaluating the usage of new economical technologies [11].

To confirm the adequacy of this model we analyzed the process of change of the productivity of road-building cars in different intervals of work. Using the regressive analyses we investigated the influence of work on the productivity and the duration of the planning technical service and the repairs of some building cars [3, 6, 7]. As the result of the regressive analyses we created linear dependences, we determined the limits of the parameters of the regression and the dispersion of casual quantity of the productivity, the duration of planned technical services and the repair of different intervals of the work with probability 0,95, 0,99.

We also proposed some decisions in order to perfect methods for determining the rational periodicity for the repair of road-building cars [1, 5, 8].

As a result of the regressive analyses we determined the empirical dependences of the influence of the average annual duration of planned

preventive measures to the average annual duration of unplanned repairs on the example of the process of the exploitation of some types of cars [4].

Thus as a result of the investigation we proposed the methods of analyses and prediction of the significance of cars' productivity.

Then we elaborated the economic and mathematic model for the calculation of the effective structure and the composition of cars' park from the point of view of the complex examining of the systems of the productive and technical exploitation [2]. This model allows taking into account the individual productivity of each car; the expenditures of the time on the repairs of car; the condition of no surcharge changeable power of repair means; the correction of the periodicity of the technical services and repairs.

The results of the investigation were approved in some companies. The general effectiveness of the usage of cars' park increased till 46,3-54,2 %.

The methods and the general economic and mathematic model of the optimization of the usage of cars' park correspond to the conception of the rising of the effectiveness of the usage of cars' park of road –building companies. This model is characterized by the next attributive opportunities: thanks to proposed decisions we can find in the relations of the customer and the contractor a right economic motivation in the rising of the building quality , in the increasing of the terms of service of the road construction, the effective exploitation of industrial resources (including cars 'park of the company), as all these parameters are analytically connected in the elaborated model; as changeable quantities the model proposes the quantity of the car of each functional destination, type-size for all establishments and for all technological operations; the opportunity of the dynamic planning of the usage of cars' park for a long time appears, including the calculation of new orders and the work ready establishments Let us give the description of the model.

The point is to appreciate as correctly as possible the effectiveness of the usage of the means of the mechanization is possible only after examining their influence on the effectiveness of the organizing and technological decisions of the building and exploitation of the establishments during their whole life cycle including the problems of the utilization of materials that are not suitable for the exigencies of old elements of road constructions.

It is necessary to link the problems of quality provided by the means of mechanization with the effectiveness and the terms of the next exploitation of road constructions. To do it is possible by consolidating the examination of such parameters as tariff, expenditures, normative and actual terms of establishments' exploitation till the capital repair, the effectiveness during the whole investment cycle: from planning and building till exploitation of the establishment and work on its utilization.

From the other hand it is necessary to use such function that will be able to answer the main question of the optimization.

Cars' park as a mean of production is only a part of industrial resources that have properties of reciprocal partial addition, substitution and redistribution. It makes consider the effectiveness of cars' park as a part of the effectiveness of industrial program of company where the parameters of working and material resources and different expenses will be included.

Keeping these demands it is necessary in the result of calculation to make a rational choice and distribution of cars' park from the point of view of organizing and technological provision of industrial program of the company on establishments being built served and on all technological operation for the real life period of establishments.

The usage of the economic and mathematical model is possible only in the conditions of free economic relations of companies, of open competition in distribution of orders and when all the engagements are met in time.

That is why the introduction of the methods may bring the greatest effect only if to accept the conception on level of the whole region

The function having a special purpose is the total economic effect (1).from planning building of *I*-quantity of establishments and their exploitation till the capital repair considering expenses of recourses and financial results of exploitation of *K*-quantity of early built establishments. Each private annual effect can be determined on dependence (2). The annual effect from the building of *i*- establishment can be determined as a total effect on all building technological operations divided on the normative term of exploitation of this establishment.

The division of the total effect of the building on private annual effects and the division of the time of exploitation of the establishment till the capital repair of its construction on normative and real allows connecting the questions of the efficiency of exploitation of the organizing and technological decisions with the terms of service of the establishments being built. The division of the total effect of the building on private annual effects does not mean that the financing of work has to be divided on years of exploitation. But if the normative term of exploitation of establishment did not finish and the real term ended, the tariff on the building is zero (3).

The inverse situation is also possible (4). In

accordance of the limitation, till the normative term of exploitation the expenses on the building work include the expenses on the exploitation of cars, on materials, on salary and other expenses providing diminution of operational expenses. But if the normative term of exploitation of establishment finished and the real term did not end the expenses on the building in the period are zero and the tariff is the same

Thanks to these decisions a right economic motivation in the augmentation of the quality of building, of terms of service of road construction, in the effective usage of industrial recourses.

In the limitations (5, 6) you can find the expenses on the exploitation of *i*- being built and having been built establishments. These limitations are described in detail (7-35). The distribution of cars is influenced by the limitations (7-12). The model given below describes the open system of choice and destination of cars. This model is shown below:

$$Э = \sum_{n=0}^{\max(N_i^{(R)})} Э_n \to \max, \quad i = \overline{1, I}; \tag{1}$$

$$Э_n = \left[\sum_{i=1}^{I} \left(\frac{\sum_{j=1}^{J} \left[V_{ij}^{(b)} \cdot P_{ijn}^{(b)} - Z_{ijn}^{(b)} \right]}{N_i} + \sum_{l=1}^{L} \left[V_{il}^{(e)} \cdot P_{il}^{(e)} - Z_{il}^{(e)} \right] \right) + \right.$$

$$\left. + \sum_{k=1}^{K} \sum_{l=1}^{L_k} \left[V_{kl}^{(e)} \cdot P_{kl}^{(e)} - Z_{kl}^{(e)} \right] \right] \cdot \frac{1}{(1+E)^n} \to \max, \quad n = \overline{0, \max(N_i^{(R)})}; \tag{2}$$

$$P_{ijn}^{(b)} = 0, \text{ если } N_i^{(R)} < n \le N_i; \tag{3}$$

$$Z_{ij}^{(b)} = \begin{cases} W_{ij}^{(b)} + M_{ij}^{(b)} + A_{ij}^{(b)} + H_{ij}^{(b)} + Q_{ij}^{(b)} + Z_{Dij} \cdot D_{ij}, \\ i = \overline{1, I}, \quad j = \overline{1, J}, \quad \text{если} \quad n \ge N_i, \\ 0, \quad \text{если} \quad N_i < n \le N_i^{(R)}; \end{cases} \tag{4}$$

$$Z_{il}^{(e)} = W_{il}^{(e)} + M_{il}^{(e)} + A_{il}^{(e)} + H_{il}^{(e)} + Q_{il}^{(e)}, \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{5}$$

$$Z_{kl}^{(e)} = W_{kl}^{(e)} + M_{kl}^{(e)} + A_{kl}^{(e)} + H_{kl}^{(e)} + Q_{kl}^{(e)}, \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{6}$$

$$W_{ij}^{(b)} = \sum_{y=1}^{Y} \sum_{x=1}^{X} \left(C_{yx} \cdot n_{yxij}^{(b)} \cdot T_{CMyx} \cdot \left(T_{ij}^{(b)} - t_{yxij}^{(b)} \right) \right), \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{7}$$

$$\sum_{x=1}^{X} \left(П_{yxij}^{(b)} \cdot n_{yxij}^{(b)} \right) \ge \frac{V_{ij}^{(b)}}{T_{ij}^{(b)} - \sum_{x=1}^{X} \left(t_{yxij}^{(b)} \cdot n_{yxij}^{(b)} \right)}, \quad y = \overline{1, Y}, \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{8}$$

$$W_{il}^{(e)} = \sum_{y=1}^{Y} \sum_{x=1}^{X} \left(C_{yx} \cdot n_{yxil}^{(e)} \cdot T_{CMyx} \cdot \left(T_{il}^{(e)} - t_{yxil}^{(e)} \right) \right), \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{9}$$

$$\sum_{x=1}^{X} \left(П_{yxil}^{(e)} \cdot n_{yxil}^{(e)} \right) \ge \frac{V_{il}^{(e)}}{T_{il}^{(e)} - \sum_{x=1}^{X} \left(t_{yxil}^{(e)} \cdot n_{yxil}^{(e)} \right)}, \quad y = \overline{1, Y}, \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{10}$$

$$W_{kl}^{(e)} = \sum_{y=1}^{Y} \sum_{x=1}^{X} \left(C_{yx} \cdot n_{yxkl}^{(e)} \cdot T_{CMyx} \cdot \left(T_{kl}^{(e)} - t_{yxkl}^{(e)} \right) \right), \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{11}$$

$$\sum_{x=1}^{X} \left(П_{yxkl}^{(e)} \cdot n_{yxkl}^{(e)} \right) \ge \frac{V_{kl}^{(e)}}{T_{kl}^{(e)} - \sum_{x=1}^{X} \left(t_{yxkl}^{(e)} \cdot n_{yxkl}^{(e)} \right)}, \quad y = \overline{1, Y}, \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{12}$$

$$M_{ij}^{(b)} = K_{Fij}^{(b)} \cdot Z_{Mij}^{(b)} + \frac{Z_P + A_R}{S_O \cdot T_M} \cdot S_{Fij}^{(b)} \cdot T_{Fij}^{(b)} + Z_{TRij}^{(b)} + K_{Uij}^{(b)} \cdot Z_{Uij}^{(b)} \cdot O_{ij}^{(b)}, \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{13}$$

$$M_{il}^{(e)} = K_{Fil}^{(e)} \cdot Z_{Mil}^{(e)} + \frac{Z_P + A_R}{S_O \cdot T_M} \cdot S_{Fil}^{(e)} \cdot T_{Fil}^{(e)} + Z_{TRil}^{(e)} + K_{Uil}^{(e)} \cdot Z_{Uil}^{(e)} \cdot O_{il}^{(e)}, \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{14}$$

$$M_{kl}^{(e)} = K_{Fkl}^{(e)} \cdot Z_{Mkl}^{(e)} + \frac{Z_P + A_R}{S_O \cdot T_M} \cdot S_{Fkl}^{(e)} \cdot T_{Fkl}^{(e)} + Z_{TRkl}^{(e)} + K_{Ukl}^{(e)} \cdot Z_{Ukl}^{(e)} \cdot O_{kl}^{(e)}, \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{15}$$

$$Z_{TRij}^{(b)} = T_{TRij}^{(b)} \cdot P_{TRij}^{(b)}, \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{16}$$

$$T_{TRij}^{(b)} = \frac{Q_{TRij}^{(b)}}{G_{TRij}^{(b)}} \cdot \left(t_{Zij}^{(b)} + \frac{L_{TRij}^{(b)}}{X_{TR}} \right), \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{17}$$

$$Z_{TRil}^{(e)} = T_{TRil}^{(e)} \cdot P_{TRil}^{(e)}, \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{18}$$

$$T_{TRil}^{(e)} = \frac{Q_{TRil}^{(e)}}{G_{TRil}^{(e)}} \cdot \left(t_{Zil}^{(e)} + \frac{L_{TRil}^{(e)}}{X_{TR}} \right), \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{19}$$

$$Z_{TRkl}^{(e)} = T_{TRkl}^{(e)} \cdot P_{TRkl}^{(e)}, \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{20}$$

$$T_{TRkl}^{(e)} = \frac{Q_{TRkl}^{(e)}}{G_{TRkl}^{(e)}} \cdot \left(t_{Zkl}^{(e)} + \frac{L_{TRkl}^{(e)}}{X_{TR}} \right), \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{21}$$

$$A_{ij}^{(b)} = T_{Rij}^{(b)} \cdot \left(\frac{A_{\min}}{T_M} \cdot n_{\min\, ij}^{(b)} \cdot k_R \cdot k_{PRij}^{(b)} \right), \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{22}$$

$$A_{il}^{(e)} = T_{Ril}^{(e)} \cdot \left(\frac{A_{\min}}{T_M} \cdot n_{\min\, il}^{(e)} \cdot k_R \cdot k_{PRil}^{(e)} \right), \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{23}$$

$$A_{kl}^{(e)} = T_{Rkl}^{(e)} \cdot \left(\frac{A_{\min}}{T_M} \cdot n_{\min\, kl}^{(e)} \cdot k_R \cdot k_{PRkl}^{(e)} \right), \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{24}$$

$$H_{ij}^{(b)} = K_N \cdot A_{ij}^{(b)}, \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{25}$$

$$H_{il}^{(e)} = K_N \cdot A_{il}^{(e)}, \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{26}$$

$$H_{kl}^{(e)} = K_N \cdot A_{kl}^{(e)}, \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{27}$$

$$Q_{ij}^{(b)} = (k_1 + k_2 + k_3 + k_4) \cdot (W_{ij}^{(b)} + M_{ij}^{(b)} + A_{ij}^{(b)} + H_{ij}^{(b)}), \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{28}$$

$$Q_{il}^{(e)} = (k_1 + k_2 + k_3 + k_4) \cdot (W_{il}^{(e)} + M_{il}^{(e)} + A_{il}^{(e)} + H_{il}^{(e)}), \quad i = \overline{1, I}, \quad l = \overline{1, L}; \tag{29}$$

$$Q_{kl}^{(e)} = (k_1 + k_2 + k_3 + k_4) \cdot (W_{kl}^{(e)} + M_{kl}^{(e)} + A_{kl}^{(e)} + H_{kl}^{(e)}), \quad k = \overline{1, K}, \quad l = \overline{1, L}; \tag{30}$$

$$Z_{Dij} = W_{Dij}^{(b)} + M_{Dij}^{(b)} + A_{Dij}^{(b)} + H_{Dij}^{(b)} + Q_{Dij}^{(b)}, \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{31}$$

$$D_{ij} = \begin{cases} 1, & if \quad \Delta F > Z_{Dij}, \\ 0, & if \quad \Delta F < Z_{Dij}, \end{cases} \quad i = \overline{1, I}, \quad j = \overline{1, J}; \tag{32}$$

$$O_{ij}^{(b)} = \begin{cases} 1, & if\ utization\ of\ materials\ is\ necessery, \\ 0, & if\ utilization\ of\ materials\ is\ not\ necessery, \end{cases}$$
$$i = \overline{1, I}, \quad j = \overline{1, J}; \tag{33}$$

$$O_{il}^{(e)} = \begin{cases} 1, & if\ utization\ of\ materials\ is\ necessery, \\ 0, & if\ utilization\ of\ materials\ is\ not\ necessery, \end{cases}$$
$$i = \overline{1, I}, \quad l = \overline{1, L}; \tag{34}$$

$$O_{kl}^{(e)} = \begin{cases} 1, & if\ utization\ of\ materials\ is\ necessery, \\ 0, & if\ utilization\ of\ materials\ is\ not\ necessery, \end{cases}$$
$$k = \overline{1, K}, \quad l = \overline{1, L}; \tag{35}$$

$$n_{yxij} \geq 0, \quad n_{yxij} = \text{int}(n_{yxij}), \quad y = \overline{1, Y}, \quad x = \overline{1, X}, \quad i = \overline{1, J}, \quad j = \overline{1, J}, \tag{36}$$

where (b) – index for building work; (e) – index for operational work; i – number of building establishment; I – quantity of building establishments ; j – number of technological operation on building establishment; J – quantity of technological operation on building establishment; k – number of using establishment; K – quantity of using establishments; l – number of technological operation under exploitation of establishment; L –quantity of technological operations under exploitation of establishment; n – ordinal number of year; N_i – normative period of exploitation of i- establishment till capital repair ; $N_i^{(R)}$ – real period of exploitation of i-establishment; $V_{ij}^{(b)}$ – real volume of building work on i-establishment under j-technological operation; $V_{il}^{(e)}$ – real annual volume of work on l-technological operation under i-establishment; $V_{kl}^{(e)}$ – real volume of current annual work on l-technological operation under exploitation of early built k- establishment; $P_{ijn}^{(b)}$ – tariff of building work on j-technological operation on i- establishment in n-year, rub./unit of production; $P_{il}^{(e)}$ – tariff of operational work on l- technological operation on i-establishment, rub./unit of work; $P_{kl}^{(e)}$ – tariff of operational work on l-technological operation on early built k-establishment, rub./unit of work; $Z_{ijn}^{(b)}$ – expenditures on building work on j-technological operation on i- establishment in n-year; $Z_{il}^{(e)}$ – annual expenditures on l-technological operation under exploitation of i-establishment; $Z_{kl}^{(e)}$ – expenditures on current annual work on l- technological operation under exploitation of early built k-establishment; E – norm of discount; $W_{ij}^{(b)}, M_{ij}^{(b)}, A_{ij}^{(b)}, H_{ij}^{(b)}, Q_{ij}^{(b)}$ – expenditures on exploitation of cars' park, materials, salary and other expenditures under building on i-establishment on j- technological operation; $W_{il}^{(e)}, M_{il}^{(e)}, A_{il}^{(e)}, H_{il}^{(e)}, Q_{il}^{(e)}$ – expenditures on exploitation of cars' park, materials, salary and other expenditures on annual work on l- technological operation under exploitation of i- establishment; $W_{kl}^{(e)}, M_{kl}^{(e)}, A_{kl}^{(e)}, H_{kl}^{(e)}, Q_{kl}^{(e)}$ – expenditures on exploitation of cars' park, materials, salary and other expenditures on volume of current annual work on l- technological operation under exploitation of early built k- establishment; Z_{Dij} – subsidiary expenditures providing diminution of operational expenses; $W_{Dij}^{(b)}, M_{Dij}^{(b)}, A_{Dij}^{(b)}, H_{Dij}^{(b)}, Q_{Dij}^{(b)}$ – subsidiary expenditures (providing diminution of operational expenses) on exploitation of cars' park, materials, salary and other expenditures under building on i-establishment on j- technological operation, D_{ij} – changeable quantity of necessity of diminution of operational expenditures; y – functional purpose of car; Y – quantity of types of cars of park; x – type size of car; X – quantity of type sizes of cars of y- functional destination; C_{yx} – cost price of car's hour of car of-y functional destination and of x- type size; $n_{yxij}^{(b)}$ – quantity of cars of y-functional destination of x-type size on i- being built establishment, fulfilling j- technological operation; $n_{yxil}^{(e)}$ – quantity of cars y-functional destination of x- type size on l-technological operation under exploitation of i- establishment; $n_{yxkl}^{(e)}$ – quantity of cars of y- functional destination of x-type size on current annual work on l- technological operation under exploitation of early built k-

establishment; T_{CMyx} – duration of shift of car of *y*- functional destination of *x*- type size; $T_{ij}^{(b)}$ – permissible duration of building work on *i*- establishment on *j*- technological operation in shifts; $T_{il}^{(e)}$ – permissible annual duration of work on *l*- technological operation under exploitation of *i*- establishment in shifts; $T_{kl}^{(e)}$ – permissible annual duration of work on *l*- technological operation under exploitation of early built *k*- establishment in shifts; $t_{yxij}^{(b)}$ – duration of arrangement on service and repair of cars of *y*-functional destination of *x*- type size on *i*- being built establishment fulfilling *j*- technological operation in shifts; $t_{yxil}^{(e)}$ – duration of arrangement on service and repair of cars of *y*- functional destination of *x*- type size working on *l*- technological operation under exploitation of *i*- establishment in shifts; $t_{yxkl}^{(e)}$ – duration of arrangement on service and repair of cars of *y*- functional destination of *x*-type size working on *l*- technological operation under exploitation of early built *k*- establishment in shifts; $\Pi_{yxij}^{(b)}$ – middle operational productivity of cars of *y*- functional destination of *x*- type size on *i*- being built establishment fulfilling *j*- technological operation; $\Pi_{yxil}^{(e)}$ – middle operational productivity of car of *y*- functional destination of *x*-type size on *l*- technological operation under exploitation of *i*- establishment; $\Pi_{yxkl}^{(e)}$ – middle operational productivity of car of *y*- functional destination of *x*- type size on *l*- technological operation under exploitation of early built *k*- establishment; $K_{Fij}^{(b)}, Z_{Mij}^{(b)}, S_{Fij}^{(b)}, T_{Fij}^{(b)}, Z_{TRij}^{(b)}, K_{Uij}^{(b)}, Z_{Uij}^{(b)}, O_{ij}^{(b)}$ – for *i*- being built establishment and *j*-technological operation according to quantity of necessary materials, real value of materials, area occupied by materials, middle quantity of time to place materials, transport expenditures to deliver materials, quantity of materials for utilization, expenditures on utilization of unit of old materials, changeable quantity, of necessity of utilization of materials; $K_{Fil}^{(e)}, Z_{Mil}^{(e)}, S_{Fil}^{(e)}, T_{Fil}^{(e)}, Z_{TRil}^{(e)}, K_{Uil}^{(e)}, Z_{Uil}^{(e)}, O_{il}^{(e)}$ – the same but for *l*- technological operation under exploitation of *i*- establishment; $K_{Fkl}^{(e)}, Z_{Mkl}^{(e)}, S_{Fkl}^{(e)}, T_{Fkl}^{(e)}, Z_{TRkl}^{(e)}, K_{Ukl}^{(e)}, Z_{Ukl}^{(e)}, O_{kl}^{(e)}$ – the same but for *l*- technological operation under exploitation of early built *k*- establishment; Z_P – expenditures on keeping of storehouses; A_R – salary for storehouse workers; S_O – total storehouse area; T_M – quantity of work hours in month $T_{TRij}^{(b)}, P_{TRij}^{(b)}$ – с *j*- technological operation on *i*- being built establshment; $T_{TRil}^{(e)}, P_{TRil}^{(e)}$ – middle duration of transportation and cost price of usage of transport means under delivering of materials to fulfill of *l*- technological operation under exploitation of *i*- establishment; $T_{TRkl}^{(e)}, P_{TRkl}^{(e)}$ – middle duration of transportation and cost price of usage of transport means under delivering of materials to fulfill of *l*- technological operation under exploitation of early built *k*- establishment; $Q_{TRij}^{(b)}, G_{TRij}^{(b)}, t_{Zij}^{(b)}, L_{TRij}^{(b)}$ – mass of being transport materials, vehicle capacity, time of loading and unloading in one work cycle of car, middle distance of transportation of materials under securing of *j*- technological operation on *i*- being built establishment; $Q_{TRil}^{(e)}, G_{TRil}^{(e)}, t_{Zil}^{(e)}, L_{TRil}^{(e)}$ – the same but for *l*- technological operation under exploitation of *i*- establishment ; $Q_{TRkl}^{(e)}, G_{TRkl}^{(e)}, t_{Zkl}^{(e)}, L_{TRkl}^{(e)}$ – the same but for *l*- technological operation under exploitation of early built *k*- establishment; X_{TR} – middle speed of car; $T_{Rij}^{(b)}, n_{\min ij}^{(b)}, k_{PRij}^{(b)}$ –labor-intensiveness of manual labor, middle number of minimum sizes of payment in salary, coefficient considering other payments on *j*- technological operation on *i*-being built establishment;; $T_{Ril}^{(e)}, n_{\min il}^{(e)}, k_{PRil}^{(e)}$ – the same but for *l*- technological operation under exploitation of *i*- establishment;; $T_{Rkl}^{(e)}, n_{\min kl}^{(e)}, k_{PRkl}^{(e)}$ – the same but for *l*- technological operation under exploitation of early built *k*- establishment;; $A_{\min}$ – minimal month size of payment of labor; k_R – районный коэффициент к заработной плате; k_N – norm of overhead expenses, %; k_1, k_2, k_3, k_4 – coefficient considering expenses on building of temporary constructions, coefficient considering additional expenses on work in winter, coefficient considering unforeseen expenses; coefficient considering expenses on transportation of workers ΔF – economy of expenses on exploitation of establishment for real term of service.

References:

1. Ivanov V.N., Salikhov R.F. Methods of road building machines' repair rational periodicity defining // Construction mechanization - 2003. №5. – pp. 12 – 14. (Russia)

2. Ivanov V.N., Salikhov R.F. Optimization of road building machines' park structure and maintenance // Higher Education Reporter. Construction - 2002. №12. – pp. 70 – 74. (Russia)

3. Ivanov V.N., Salikhov R.F. Control and chance failure number at machines' exploitation //

Construction mechanization - 2002. №5. – pp. 28 – 29. (Russia)

4. Ivanov V.N., Salikhov R.F. Control and chance failure number at machines' exploitation // Building mechanization - 2002. №5. – pp. 28 – 29. (Russia)

5. Ivanov V.N., Salikhov R.F., Nesov K.N. Influence of construction machines' operating time on periodicity of road building machines repair // Higher Education Reporter. Construction - 2004. №4. – pp. 91 – 94. (Russia)

6. Ivanov V.N., Salikhov R.F., Nesov K.N. Bulldozer working capacity and repair time dependence on operating time // Construction mechanization - 2004. №6. – pp. 30 – 32. (Russia)

7. Ivanov V.N., Salikhov R.F., Shchukin K.V. Maintenance and operating time influence on road building machines' working capacity // Higher Education Reporter. Construction - 2003. №3. – pp. 97 – 100. (Russia)

8. Ivanov V.N., Salikhov R.F., Shchukin K.V. Criterion of road building machines' repair rational periodicity defining // Road-building machinery - 2003. №2. – pp. 29 – 30. (Russia)

9. Odintsov D.G., Ivanov V.N., Klopunov I.S. Various materials soft roof cladding installation works' production cost structure analysis // Building materials - 2001. №6. – pp. 24 - 25. (Russia)

10. Odintsov D.G., Ivanov V.N., Klopunov I.S. Choice of construction activity rational technology variant // Higher Education Reporter. Construction - 2001. №11. – pp. 71 - 73.

11. Permyakov V.B., Ivanov V.N. Road party work analysis with remixer // Higher Education Reporter. Construction - 1997.- №12. - pp. 98-101. (Russia)

12. Permyakov V.B., Ivanov V.N. Mathematical model of road builders' machine park structure // Higher Education Reporter. Construction - 1998. - №7. – pp. 93 - 96. (Russia)

13. Permyakov V.B., Ivanov V.N. Ways of machinery systems' work efficiency upgrading in road making // Higher Education Reporter. Construction - 2000. - №11. - C.82 – 86. (Russia)

14. Permyakov V.B., Ivanov V.N. Mechanical means use efficiency in construction operations: Monograph – Omsk: Publishing House of SibRTI, 2002. – p.192. (Russia)

15. Permyakov V.B., Odintsov D.G., Ivanov V.N., Klopunov I.S. Economic and mathematical model of efficiency determination of construction works' organization and technology option // Higher Education Reporter. Construction - 2001. №1. – pp. 53 - 57. (Russia)

The article is admitted to the International Scientific Conference « Basic and applied research. Education, economics and right, Italy (Rimini), September 9-16, 2006, came to the editorial office on 15.11.07