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METHODICAL PROVISION NEEDS OF MOBILE MAINTENANCE OF FOREST MEW

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The paper presents results on the methodological regulations describing mathematical models of equipment needed to ensure the maintenance of forest MEW.

Means, maintenance, forest MEW.

Problem. At present - principles of operation tehobsluhovuyuchyh forms Forestry Machines: bezmonopolnist, creative entrepreneurship, high performance malozatratnist - are only good intentions to be even introduce in certain organizational, technical and legal conditions.

Analysis of recent research. We believe that maintenance and troubleshooting equipment Enterprise Park Forest Complex is a mobile tool. You may assume that there is a need for a means is random [1].

If the need arises at a time when mobile agent is busy doing other needs that arose before, the maintenance is done with some delay. The magnitude of the delay depends on the nature and needs of the specific production situation. Failures encountered during operation of the equipment and cause disability, should be eliminated first. Failures that cause the loss of the healthy state of equipment removed when troubleshooting will be associated with disability, but before entering service.

On the other hand, as a result of the random nature of the occurrence of failures is a simple mobile means, as immediately after the removal of another failure can not guarantee the availability of the new requirements for maintenance and troubleshooting. Delays in anticipation of service as a simple mobile means, we can estimate certain costs.

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Existing methods of calculating the total tehobsluhovuvanya [1] does not take into account the direction and type of forest management [2], technology and timing of production forest complex is not possible to determine the volume of works on in terms of calendar dates, and, consequently, actual needs workforce for a specific sector [3]. Existing methods for selection of logistics maintenance for a given economy based only on the quantitative part of the equipment sector [4]. It does not take into account the actual equipment needs households, depending on the specific conditions of production and future strategy of its economic activity. Costs have opposite trends as the number of mobile: costs related to early expectations reduced maintenance and costs caused by downtime mobile means increase (ratio decreases their use).

The purpose of research. It appears appropriate to determine the need for optimal cell mass of a particular type (acquisition), in which the amount of expenses for the maintenance of these facilities and the costs associated with downtime Forestry Machines pending service will be minimal. Sometimes it is also desirable to choose the best type of mobile technology with several applied.

Results. The above-described purpose envision queuing model with the following specification general concepts:

- source needs - Park equipment forest complex, which is operated in forestry for the production (growing) products;
- the need for maintenance - the need to eliminate failures and maintenance services;
- channel service - a mobile vehicle.

Since the service is subject to a significant amount of equipment (skidding machines, plows, planting machines, tractors, cars, woodworking machines, etc.), it is justified to use open queuing system, also known as a system with unlimited sources needs). Therefore, we assume that the need to eliminate failures occur at random time (the duration of the interval between the occurrence of two needs - exponential random variable). Furthermore it is assumed that the working time of mobile coincides approximately with working time equipment serviced (needs arise only at this time).

Of the possible subjects take care relative priority, characterized in that each has begun execution order of the repair is completed fully. Just after the release of mobile phase is selected from the following priority needs.

Maintenance made homogeneous single-phase parallel channels, that one need is provided by mobile agent.

Duration removal of a failure - a random variable. Services include moving to a place of mobile equipment operation. Type distribution of the service time depends on the location of my exploits machinery parts of Forestry and failure rate of structural elements of the equipment.

The above system is different from the open queuing system with the expectation mainly on two properties: the distribution of the service time is not always pidchynyayetsya exponential law; Some needs are characterized by relative priority.

Output. Previously we note that the values that apply only to priority and non-priority needs, denote, respectively, the indices 1 and 2. Type the following parameters, which are the raw data, or determined on the basis of: t1, t2 - the average length of the interval between the occurrence of two purposes; τ_1,τ_2 - The average length of service of a need; ν (T) - the coefficient of variation of the service time (ratio of standard deviation to the mean of the random variable);ρ_1,ρ_2,ρ - Load, which indicates the average number of full time employment of mobile and which in our model is also equal to the average number of simultaneous obsluhovuyemyh needs (defined as the ratio of load: $\rho_1 = \frac{\tau_1}{t_1}$; $\rho_2 = \frac{\tau_2}{t_2}$; $\rho = \rho_1 + \rho_2$) S - number of mobile service channels. To mobile tool could meet all the needs for service must be the condition $S > \rho$.

Introduce of specific expenses: C_τ - Share the cost of using mobile agent, UAH / hour (assuming that this part of the cost is the same for non-priority needs and priorities); CF - the average cost of one hour of simple mobile means USD / hour; C1, C2 - loss per hour of downtime loss of production due to violation of terms of optimal agronomic work due to downtime, respectively, priority and non-priority needs.

We introduce also the following operational characteristics of the method which will be described below: L1 (S), L2 (S), L (S) - the mean (average number of needs that are awaiting the start of service); T1 (S), T2 (S) - the average waiting time in the queue one needs, including needs who did not have during the early service.

Functions goal. Optimality criterion is the average total costs arising in connection with the process of service within the time unit of the system. This value will be minimized. We can assume that costs are directly proportional to the length of the state, with aspect ratio is appropriate specific expenses. On average, both are busyρ Mobile assets in other quantities $S - \rho$ idle. Simultaneously performed on average ρ_1 Serviced priority; amount of service time priority needs in line presents $L_1(S)$ units of time within a unit of work (similar to non-priority needs).

The objective function whose value is denoted by the symbol $z(S)$ And he called complete, can be determined from the expression:

$$z(S) = \rho \cdot C_\tau + (S - \rho) \cdot C_f + L_1(S) \cdot C_1 + L_2(S) \cdot C_2 . \qquad (1)$$

The expression for operating characteristics. The symbol $L(S, \rho)$ denote the average queue length for open queuing system $M/M/S$ with expectations. This value, which depends on the number of channels of S and downloads ρCalculated by generally known formula:

$$L(S,\rho)=\frac{\rho^{S+1}\cdot P_0}{(S-\rho)^2\cdot(S-1)!};\quad (S>\rho),\tag{2}$$

whereby the auxiliary value P0 determined by the ratio:

$$P_0=\frac{1}{\sum_{i=0}^{S-1}\frac{\rho_i}{i!}+\frac{\rho^S}{(S-\rho)\cdot(S-1)!}}.\tag{3}$$

Feature Value $L(S,\rho)$ (Ranging from 0.1 to 10) is possible with sufficient certainty to practice on nomograms [2].

Approximation of the average queue length for a system with an arbitrary distribution of the service time represented by the formula:

$$L(S)\approx\frac{1+[\nu(\tau)]^2}{2}\cdot L(S,\rho).\tag{3}$$

Mean length of queue priority and non-priority needs of the value obtained after $L(S)$ formula (4.16) with the relations:

$$L_1(S)=\frac{\rho_1\cdot(S-\rho)}{\rho\cdot(S-\rho_1)}\cdot L(S);\tag{4}$$

$$L_2(S)=L(S)-L_1(S).\tag{5}$$

The average waiting time is closely related to the average queue length of a simple ratio, which is derived in [2]:

$$T_1(S)=t_1\cdot L_1(S);\tag{6}$$

$$T_2(S)=t_2\cdot L_2(S).\tag{7}$$

Determining the optimal number of mobile. When applying the simplified optimization objective function whose value can mark symbol $z'(S)$. This function includes only those members full function $z(S)$ Which depend on the S That is optimized:

$$z'(S)=S\cdot C_f+L_1(S)\cdot C_1+L_2(S)\cdot C_2.\tag{8}$$

Difference $z(S)=z'(S)=\rho\cdot(C_\tau-C_f)$ has the same value for any number $S>\rho$ mobile tools. That is, the function (1) and (8) take the minimum value for the same number of mobile media, which is denoted by the symbol S^{opt}.

The optimal number of mobile can be determined by brute force. First and foremost is the minimum allowable amount $S_{\min}$ mobile agents, which is equal to an integer closer exceeding load. Size $S_{\min}$ satisfies the condition:

$$\rho=S_{\min}\leq\rho+1.\tag{9}$$

To $S=S_{\min}$ define the value $z'(S)$ the expression (8). size $L_1(S)$ and $L_2(S)$ determined by formulas (4) and (5) using the approximation (3); the desired value $L(S,\rho)$ the expression (2) is determined by the nomogram [2]. Then the number of mobile incremented and calculation $z'(S)$

repeated. The increase in S continues as long as the costs are reduced. If you get $z'(S+1) > z'(S)$ The calculation is terminated. The optimal number of S^{opt} corresponds to the minimum of the function $z'(S)$. In the exceptional case $z'(S) = z'(S+1)$ There are two alternative solutions: $S^{opt} = S_{\min}$ and $S^{opt} = S_{\min} + 1$.

If after the first step of calculating get $z'(S+1) > z'(S)$ Then there is an optimum $S^{opt} = S_{\min}$. Sometimes you can finish the process of increasing S There are at $z'(S-1) < z'(S)$ If no value calculation $z'(S+1)$ it is obvious that $z'(S+1) > z'(S)$. The sufficient condition is to perform a certain step inequalities:

$$L_1(S) \cdot C_1 + L_2(S) \cdot C_2 < C_f \text{ .} \qquad (10)$$

Then majestic expenses C_f the maintenance of additional $(S+1)$ th cell vehicle is greater than the sum of costs needs while waiting S mobile media. Even with $L_1(S) \cdot C_1 = L_2(S+1) = 0$ (If you add, eliminate all expectations means) would be the option of $(S+1)$ of mobile disadvantageous.

Identification of specific costs C_1 and C_2 in practice it is often quite close by, so the ratio C_1/C_2 in many cases, can be estimated with greater certainty.

Check optimum sensitivity obtained S^{opt} to replace these costs due to the fact that defined number of mobile number is some optimum value range C_1 and C_2.

The symbol $C_2(S, S+1)$ denote the threshold value C_2 In which the optimum is both S And $S+1$ mobile tools. Suppose that the ratio C_1/C_2 were evaluated. After SUBSTITUTION formula $\rho_1 = \frac{\tau_1}{t_1}; \rho_2 = \frac{\tau_2}{t_2}; \rho = \rho_1 + \rho_2$ in equality $z'(S) = z'(S+1)$ this value can be expressed as follows:

$$C_2(S, S+1) = -\frac{C_f}{\frac{C_1}{C_2} \cdot L_1(S) - L_1(S+1) + L_2(S) - L_2(S+1)} \text{ .} \qquad (11)$$

The resulting higher S^{opt} and is optimum for all values C_2 within $C_2\left(S^{opt} - 1, S^{opt}\right)$ to $C_2\left(S^{opt}, S^{opt} + 1\right)$ Assuming $C_1/C_2 = const$ (At $S^{opt} = S_{\min}$ lower limit is zero). If this range is wide and if overall value C_2 is not very close to one of the specified limit, the more precise estimate C_2 there is no need. Similarly, we can define the threshold $C_1(S, S+1)$ size C_1; in effect $C_1(S, S+1) = C_2(S, S+1) \cdot {C_1}/{C_2}$.

Conclusions. The basis for the establishment of maintenance equipment forest complex methods are specialized maintenance machines that take into account the specific conditions of forest production with the use of mobile devices; alteration of the active material and technical base of enterprises; providing producers with technical services in the "purchase - operation - maintenance"; selection of artist maintenance is based on its technical capacity and financial equipment owner, and proposed mathematical model for calculating the need for mobile vehicles will implement them efficiently.

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In this article predstavlenы Results for methodical descriptions provisions Mathematical models Provision potrebnosty in funds tehnycheskoho Maintenance lesnыh МЭС.

Funds, Tehnicheskoe Maintenance, lesnoe МЭС.

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STABILITY PARAMETERS front mezze OF WORK

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