

OUTPUT PER YEAR OR OTHER PERIOD OF PLANNING TECHNICAL SERVICE

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Abstract. In order to specify the time of the technical service of automobiles and to co-ordinate it with the specialized service enterprises it is necessary to do long-term (technical – economic) as well as operative planning. In order to plan the technical service for different groups of automobiles their various operation regimes should be considered. In order to specify for planning the total direct time necessary for servicing an automobile we suggest correcting it with the technical coefficient of using the automobiles.

Key words: automobile, tractor, technical service, coefficient of technical usage.

Introduction

In small and medium transport and agricultural enterprises the periodical technical service of power vehicles (TS) that is not technologically complicated but repeats often is usually carried out by the enterprises themselves on the spot. More time consuming and connected with repair TS operations are often done using the help of special service enterprises. Also the TS operations that must be done for the new automobiles during the time of their guarantee should be co-ordinated with the automobile dealers.

In order to co-ordinate the time necessary for the TS with the definite operation plans of the enterprise and the specialized service enterprises long-term and operative planning is necessary.

Planning the TS and repair work the characteristic automobile operation regime of the enterprise should be considered. At the same time it must be taken into account that for different machines, such as automobiles, tractors, forest logging machinery etc. depending on the trend of the enterprise operation and specialization their daily, monthly (season) or yearly regime can be different.

The research work suggests a method to determine specified working time and output for power vehicles in the TS planning period.

Discussion and results

Applying power vehicles it is essential how often the technical service should be done and how many technical services will be carried out in the accounting period. As the longest period of exploitation the usage of power vehicles from the moment of purchasing them till their write-off or also selling can be considered. This way it is possible to plan the expenses of power vehicle exploitation. It is essential for the development of the yearly budget of the enterprises but on smaller farms – for planning the expenses in a shorter period of exploitation, for instance, for a year.

The dealers of power vehicles today have a tendency to enlarge the period between servicing. Such enlargement is possible using qualitative exploitation materials, precisely producing and mating power vehicle units and parts as well as using the up-dated technologies in diagnosis of the technical condition of power vehicles, for instance, sending the power vehicle parameter and specifically found “errors” to the dispatcher by means of satellite.

The enlargement of the output between servicing is based also on the reducing of the number of units of power vehicles to be served. If in the units of power vehicles that were produced 40 – 50 years ago a large number of lubricant valves was used it was advisable to lubricate these units after 2 – 3 thousand kilometers, today usually units that are not services are used in which the consistent grease is filled in the plant at mounting. It is not necessary to replace this grease during the whole time of exploitation. In case, if the output between servicing is enlarged it is possible to reduce the power vehicle exploitation expenses essentially [1]. During the last 30 years the output between servicing has increased from 5 – 10 times. Sometimes the enlargement of the period between servicing is done also based on the competition as from the point of view of exploitation of power vehicles it is essential to reduce this period this way reducing the exploitation costs. The summary costs of technical servicing in a definite period of time depending on the coverage in between servicing are shown in Figure 1. The optimal output between servicing is marked as X_{opt} .

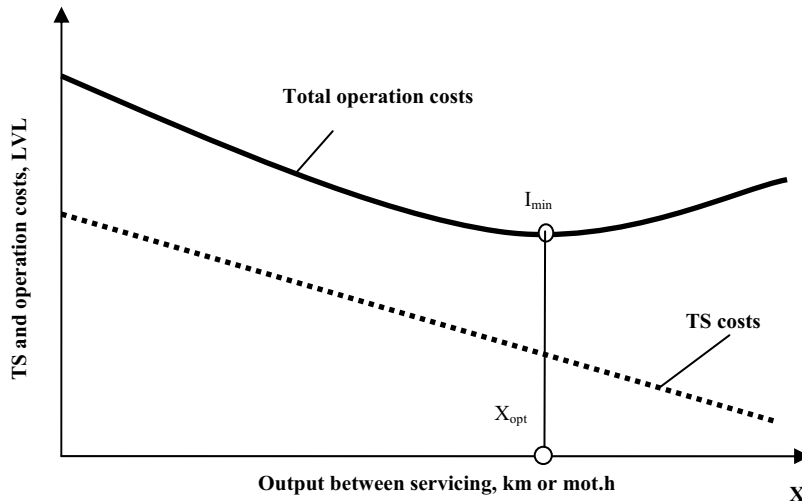


Fig. 1. Changes of the technical servicing costs depending on the output between servicing

For tractors and other specialized mobile working machines the average daily working hours is usually determined in moto hours and its average value for every definite machine will be – $t_{i.vid}$:

$$t_{i.vid} = t_m n_m k_m, \tag{1}$$

where t_m – length of a working day or shift in hours;
 n_m – number of shifts or shift coefficient;
 k_m – recalculation of length of shift in moto hours.

For automobiles the average daily usage is usually characterized by their average daily coverage km $l_{i.vid}$:

$$l_{i.vid} = \frac{l_{per}}{D_d}, \tag{2}$$

where l_{per} – coverage of the automobile in a definite period, for instance, in a year;
 D_d – number of working days per year.

For starting to plan the TS in a year or a shorter period of machine operation the number of working days D_d in which it is planned to use the machine should be known:

$$D_d = D_k - (D_{sv.d.} + D_{met} + D_{org} + D_p) \tag{3}$$

where D_k – calendar number of days in the planned period;
 $D_{sv.d.}$ – festivals and holidays when the machines will not be used;
 D_{met} – time – out due to meteorological conditions;
 D_{org} – time – out due to organisation of work;
 D_p – time – out due to the lack of work or labour force.

The time-out due to meteorological conditions can be evaluated proportionally and it will depend also on the specificity of the work to be done. In agricultural enterprises in our climatic zone it can be assumed 3...5% of the total planned working time. D_{org} and D_p is evaluated individually by every enterprise for their machines [2].

In the calculations it must be considered that in the planned working days of a machine D_d it will be used for doing the direct duties as well as it will be used for the planned technical servicing work.

Therefore, in the period of planning the TS the total direct working hours in moto hours T_p for tractors and specialised mobile machines will be:

$$T_p = D_d t_{i.vid} K_{TI}, \tag{4}$$

but the planned coverage for the automobiles L_p in kilometers

$$L_p = D_d l_{i.vid} K_{TI} \tag{5}$$

where K_{TI} – machine technical operation coefficient that can be calculated for the planned TS period.

Inserting the expression 2 in the correlation 5 we obtain:

$$L_p = \frac{D_d l_{per}}{D_d} K_{TI} = l_{per} K_{TI}, \quad (6)$$

$$K_{TI} = \frac{D_{dd}}{D_{dd} + D_{d.TA}} = \frac{1}{1 + \frac{D_{d.TA}}{D_{dd}}} = \frac{1}{1 + D_i \cdot t_{ivid}}, \quad (7)$$

where D_{dd} – machine days directly at work;
 $D_{d.TA}$ – machine days necessary for the planned TS;
 D_i – the TS specific daily time-out.

For the tractor machinery TS the specific daily time – out D_i^T – day/mot.h can be calculated

$$D_i^T = \frac{D_1}{t_1} \left(1 - \frac{t_1}{t_2}\right) + \frac{D_2}{t_2} \left(1 - \frac{t_2}{t_3}\right) + \dots + \frac{D_n}{t_n} \left(1 - \frac{t_n}{t_{n+1}}\right), \quad (8)$$

where $D_1; D_2; D_n$ – periodical TS time in days starting with the simplest servicing and finishing with the most time consuming in the cycle of TS;
 $t_1; t_2; t_n$ – periodicity of separate TS;

$\left(1 - \frac{t_1}{t_2}\right)$ – the relation considering the basic principle of the system of technical

servicing. Every next $n+1$ in its list of work includes the work of the previous n servicing. For those machines for which the seasonal technical servicing is planned and carried out it is not included in these calculations [3].

For automobiles the specific TS daily time-out D_i^A can be calculated analogous as for the tractor machinery, only considering the planning of the TS according to the kilometers covered.

$$K_{TI} = \frac{1}{1 + D_i^A \cdot l_{i.vid}}. \quad (9)$$

Conclusions

1. The specified output of tractor machinery per year or any other period of planning the TS in moto hours, but for automobiles in the covered kilometers gives a possibility to calculate more exactly the number of the TS and to plan it operatively applying the methods generally accepted in practice.
2. The coverage of power vehicles in between servicing cannot be enlarged without any limit due to the increase of the exploitation costs. The exploitation costs increase in relation to the increase of the repair costs.
3. For all power vehicles it is useful to introduce the coefficient of the technical application of the machines that can be calculated for the planned TS period according to the kind of the machine exploitation.
4. Specifying the number of the TS in a definite period for the enterprises it is possible to elaborate the budget more exactly.
5. It is necessary for the owners of the power vehicles as well as for their dealer centers to plan their yearly output in order to increase the capacity of the service in due time.

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