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Methodology for Determining the Terms of Write-Off of Buses Operating in Tashkent City

Karimov Islomjon Toxirjon-o‘g‘li
Assistant of the “Automotive and automobile industry” department, Tashkent State Transport University, Tashkent, Republic of Uzbekistan

Vasik Ulashevich Jovliyev
Senior teacher of the “Automotive and automotive industry” department, Tashkent State Transport University, Tashkent, Republic of Uzbekistan

Otaqo‘ziyev Doniyor Inomjon-o‘g‘li
Assistant of the “Department of automotive and production engineering” department, Tashkent State Transport University, Tashkent, Republic of Uzbekistan

Abstract: *This article, as buses age, the complexity of its current repair and downtime in maintenance and repair increase, the cost of spare parts and repairs increases, and the reliability of vehicle units and components decreases, which, in turn, leads to an increase in the number of sudden bus failures in during its operation on the route. Significant funds are spent every year to subsidize the expenses of passenger enterprises. The costs of ensuring the production activities of motor transport enterprises remain high, and the efficiency of the use of rolling stock is low, while the number of failures and malfunctions of buses on the line is increasing. In order for the standard service life related to this object to be used to determine the distribution parameters, we take into account that the standard service life is the calendar time during which the object must function properly.*

Keywords: *operation, car, means, bus, resource, transport.*

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In connection with the intensive socio-economic development of the city of Tashkent, the requirements for urban passenger transportation, and, consequently, for the vehicles that carry them out, are significantly increasing. The main public transport in the city are bus, subway, cars. Significant funds are spent every year to subsidize the expenses of passenger enterprises. The costs of ensuring the production activities of motor transport enterprises remain high, and the efficiency of the use of rolling stock is low, while the number of failures and malfunctions of buses on the line is increasing. Different sizes of enterprises, low level of mechanization of maintenance and repair (M&R), lack of stable supplies of spare parts and materials, necessary technological equipment, etc. cause significant downtime for buses waiting for repairs.

Bus enterprises and service centers daily solve a number of issues related to the improvement of passenger transportation services through rational operation, resource optimization, passenger safety improvement, improvement of the transportation route network, as well as the quality of services provided.

However, the age of the rolling stock has a significant impact on the quality of the services provided and on the amount of financial, material, energy, and labor resources spent to maintain the fleet in working condition. With the aging of buses, the complexity of its current repair and downtime in maintenance and repair increase, the cost of spare parts and repairs increases, and the reliability of vehicle units and components decreases, which, in turn, leads to an increase in the number of sudden failures of the bus during its operation. Operation on the route.

Determining the optimal life of buses at an enterprise from an economic, technical and operational point of view will ensure high quality of passenger transportation, increase the income of the enterprise, optimize the work of the engineering and technical service, and also predict the work of the enterprise is relevant.

In order for the standard service life related to this object to be used to determine the distribution parameters, we take into account that the standard service life is the calendar time during which the object must function properly. In essence, the standard service life indicates the minimum time during which the object must be operated if no abnormal situations occur. An analysis of the literature summarizing numerous studies on the reliability and durability of machines and equipment shows that the coefficient of variation for machines and equipment lies in the range: 0.3 - 0.4. Thus, if we assume that an object with a high probability (for example, 0.9) should serve for a given period, then from the point of view of the adopted model, the standard period is a 10 percent quantile of the distribution.

The values of the indicators change as the buses age. The coefficient of technical readiness decreases, and operating costs Z grow with an intensity of about 1.5 ... 4% per year. These changes are quite well (with an adequacy of 0.88…0.92) described by an exponential dependence with a parameter equal to 0.012…0.048 year-1 (the aging parameter in terms of operating time t and costs z):

$$K_{\text{г}}(t) = \frac{T_p(t)}{T_p(t) + T_H(t)} = \exp(-\beta_t t)$$

To do this, it is necessary to determine the remaining service life.

This method is the cost of maintaining the rolling stock using the “Method for determining the optimal service life of machines using an automated control system” proposed by Larin P.G. etc., which looks like:

$Z(t)=\sum Z_i\ (t) =\sum\{[A_i\ (t)+ З_i +Z_{\text{ПЭБ}i} +Z_{\text{ВС}i} +H_i +Z_{\text{пр}}]+[Z_{\text{ГСМ}i}\ (t)+ Z_{\text{ТОР}i}\ (t)]\}$ сум,

Where **i –** serial number of buses in the park;

A_i (t)- Depreciation deductions;

$З_i$- Drivers salary;

$Z_{\text{ПЭБ}i}$- The cost of maintaining the production and technical base;

$Z_{\text{ВС}i}$- Deductions to a higher organization, founders, etc.;

H_i- Taxes

$Z_{\text{пр}}$- Other deductions (for insurance, bank interest on loans, lease payments, permits, technical inspections, etc.);

$Z_{\text{ГСМ}i}$(t) - the cost of fuels and lubricants and working fluids;

$Z_{\text{ТОР}i}$ (t) - maintenance and repair costs, including spare parts and wearing parts.

The figure illustrates the change in profit from the period of operation. The rational period of operation is the period when the maximum arrived. However, it decreases to zero, and the time it takes to reach this moment is considered the end of the bus operation, i.e. write-off period.

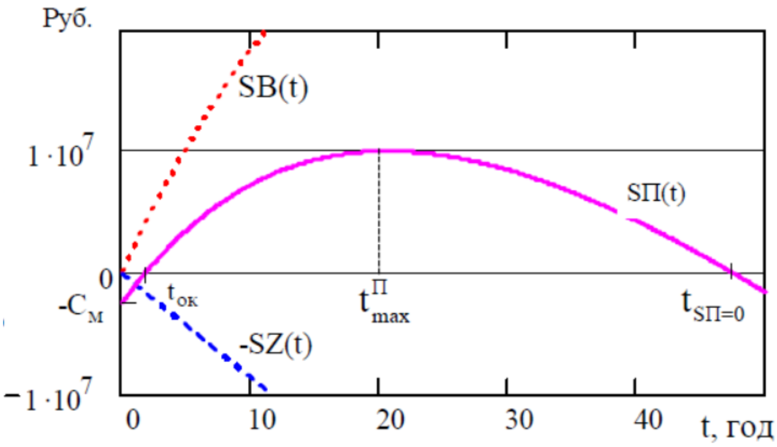

Fig. Profit changes over the life of the buses.

The components of formula (1) are called conditionally fixed costs post Z (t), not dependent on the amount of work performed during the billing period, but dependent on the average age of the fleet buses.

The second term is variable costs per Z (t) , increasing in proportion to the amount of work performed.

Profit P(t) is the difference between revenue B(t) and costs Z(t)

$$S\Pi(t) = -C_M + SB(t) - SZ(t)$$

Performing simple transformations, we obtain expressions for determining the bus write-off period:

Formula: $(t)=\sum Z_i\ (t) = \sum\{[A_i\ (t) + З_i + Z_{ПЭБi} + Z_{BCi} + H_i + Z_{пр}] + [Z_{ГСМi}\ (t) + Z_{TOPi}\ (t)]\}=168331$ thousand sum

$SP(t) = -C_M + SB(t) - SZ(t)$ - using this equation, we determine the write-off period. Example:

$C_М = 630000$ тыс, сум,

SB=∑B(t)=218270*12=2619240 тыс,сум

SZ(t)=∑Z(t)=168331 тыс,сум

To determine the write-off period, we accept SP(t)=0.

$$0 = -630000 + 2619240 - 168331 * t$$

Performing simple transformations, we obtain

t = (2619240-630000)/168331=11.8≈12 years.

Thus, for this bus, the write-off period can be taken equal to 12 years.

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