APLICATION OF MODEL FOR TRACKING TRAFIC VOLUME IRREGULARITIES AND DEGREE OF TECHNICAL CORRECTNESS

ПРИМЕНЕНИЕ МОДЕЛИ О НЕРАВНОМЕРНОСТИ ОБЪЕМА РЕЛЬСОВОГО ТРАФИКА И СТЕПЕНИ ТЕХНИЧЕСКОЙ КОРРЕКТНОСТИ

Ass. Prof. Dr. Dukoski I.[1], Ass. grad. mech.eng Sretenova Simjanovska V.[2]
Faculty of Technical Sciences – Bitola
E-mail: divo@mt.net.mk[1]; E-mail: verass@mt.net.mk[2]

Abstract: *Degree of availability of vehicles in vehicle park in a transport enterprise which basic activity is passengers and goods transport in most cases is tracked by factor of technical correctness. From tracking of this factor conclusions can be made about degree of efficiency of vehicle maintenance and use of its capacities, but it is a good indicator for performing activities and taking measures in organization of exploits of capacities. Indicts of this factor is unbeatable but influence of its change on executing the transport business is seen afterwards. New period for tracking technical correctness is necessary to see irregularity in volume of transported goods. In this paper a view of a model for quantification the technical correctness of vehicles in vehicle Park in correlation of volume of irregularity between supposed and executed transport job. This exploration was done for checking the model in JSP Skopje.*
***KEYWORDS**: TRANSPORT SYSTEM, LOGISTIC SUPPORT ELEMENTS, MODELING, SIMULATION*

1. Basic conditions

Irregularities of a transport volume and transport engagement makes difficulties to the working rhythm of vehicles in vehicle park. For decreasing negative consequences it is necessary to adjust the working rhythm of vehicles in vehicle park, which means to adjust transport ability to dynamics of change of transport demands. Also it is necessary to adjust level of technical correctness of vehicles in vehicle park to exploitation demands. With this highest level of technical correctness is achieved in the moment when there is highest demand for transport tasks and lowest level in period with lower transport demands.

In basics, often, realization of announced transport task is not planed for certain transport unit, but it is realized by ready transport unit (it such exist) for specific transport group, while other transport units available are distributed in circle to other announced transport tasks. Problems on which we can come into while optimizing the degree of transport ability of transport enterprise are:

- to which level to increase readiness of transport units,
- to which level and by which way to invest in transport capacities of the transport enterprise,
- on which criteria to relay politics for maintenance etc.

Today for practical representing we use α_t, α' and $\alpha(1)$ parameters. Actual value of factor of technical correctness of vehicle park (α_t) is determined by division of number of technically correct transport units by total number of transport units in vehicle park. Factor of usage of technically correct transport vehicle park (α') is determined by division of number of transport units and number of technically correct transport units. Their product determines factor of usage of vehicles in vehicle park ($\alpha(1)$).

These factors are indicative and relatively rough determines the potential of vehicles in vehicle park in correlation to its usage and technical correctness. They are calculated usually for one or two time sequences during the day and give us a picture for conditions in those sequences. They are used with balancing of calculated cumulative values of these factors which do not allow quantification of influences of technical correctness and usage of transport units for realization of certain transport task.

2. Applying the model and its verification

Inability to dynamic foresee the change of these factors and furthermore, side by side dealing with demands which planed transport job asks, are main handicaps of this approach which leads us to problem: for how much we should increase or decrease α_t and by which way to get increased economic efficiency of the transport enterprise.

Starting with the fact that, level of technical correctness during representative time period should be optimal according to changes in volume of transport and transport job we can include and use current factors of irregularities which tell us for the relation between volume of transport and transport job in every representative time period to average by year, as follows:

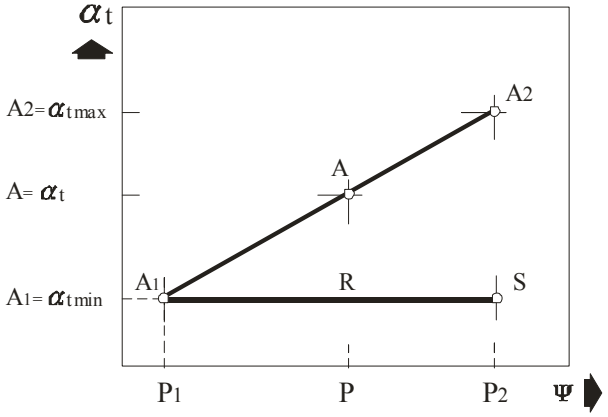
$$\psi_{Qi} = \frac{Qi}{Qsr} \quad \text{и} \quad \psi_{Ui} = \frac{Ui}{Usr}$$

Problem can be solved by determined single line trough two points where: /2/,

A_1 ($\psi\min$, $\alpha t\min$)

A_2 (ψi, αti)

A_2 A_2 ($\psi\max$, $\alpha t\max$)



Fg.1. Setting of technical correctness and transport demands according to vehicle park

Here:

$$\psi i = OP\,;\quad \psi\max = OP_2\,;\quad \psi i = OP$$
$$\psi i - \psi\min = A_1R\ ;\quad \psi\max - \psi\min = A_1S\ ;$$
$$\alpha t_{\min} = P_1A_1\ ;\ \alpha t_{\max} = P_2A_2\ ;\ \text{и}\ \ \alpha ti = PA\ ;$$
$$\alpha ti - \alpha t_{\min} = RA \quad \text{и} \quad \alpha t_{\max} - \alpha t_{\min} = SA_2$$

Straight line trough two points A_1 and A_2 is defined by next determinant:

$$\begin{vmatrix} (\psi \max - \psi \min) & \alpha t \max - \alpha t \min \\ (\psi i - \psi \min & \alpha t i - \alpha t \min \end{vmatrix} = 0$$

by which the points A_1 and A_2 and current point lay on the same straight line, which represents the proportional dependence of catetas of straight angle triangles A_1RA and A_1SA_2

$$(\psi \max - \psi \min)(\alpha t i - \alpha t \min) - (\psi i - \psi \min)(\alpha t \max - \alpha t \min) = 0$$

$$(\psi \max - \psi \min)(\alpha t i - \alpha t \min) = (\psi i - \psi \min)(\alpha t \max - \alpha t \min)$$

furthermore it will be:

$$\frac{\psi i - \psi \min}{\psi_{\max} - \psi_{\min}} = \frac{\beta_{ti} - \alpha_{t\min}}{\alpha_{ti} - \alpha_{t\min}}$$

$$\alpha_{ti} - \alpha_{t\min} = \frac{\psi_i - \psi_{\min}}{\psi_{\max} - \psi_{\min}} (\alpha t \max - \alpha t \min)$$

By that way finally we get expression for current value of factor of technical correctness which is between minimal and maximal value, and is according with demands and dynamics of change by represented time (month, week, day, hour), which follows:

$$\alpha t i = \alpha t_{\min} + \frac{\psi i - \psi \min}{\psi \max - \psi \min} (\alpha t \max - \alpha t \min)$$

The appliance of this sheet will be shown on real example for realized volume of transported passages and realized volume of transport job for one year period (1998) in Public transport enterprise (JSP) in Skopje, /Table 1/.

$$\overline{Q} = \frac{97.046}{12} = 8.086 \; ; \quad \overline{U} = \frac{139.882}{12} = 11.659$$

Based on own exploration we come to conclusion that for these vehicle park average value for $\alpha t \min = 077$ and for $\alpha t \max = 0.92$, so this values applied in expression for $\alpha t i$ give us the value for αt for represented time period – month in accordance to change in volume of passengers transport for that month. From the table:

$$\psi_{Q\max} = 1.149 \qquad \psi_{Q\min} = 0.638$$

$$\alpha t_{Qi} = 0.77 + \frac{\psi_{Qi} - 0.638}{1.149 - 0.638}(0.92 - 0.77)$$

If we replace the values for ψ_{Qi} we will get the change of value of αt_i which is fully in accordance with change in volume of transport.

Also from the table:

$$\psi_{U\max} = 1.210 \qquad \psi_{U\min} = 0.548$$

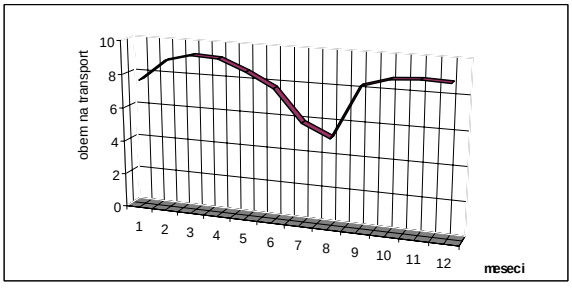
Current value of the factor of technical correctness in function of change of the volume of transport job during one representative time period we can get by inserting the values for ψ_{Ui} in following expression:

$$\alpha t_{Ui} = 0.77 + \frac{\psi_{Ui} - 0.548}{1.210 - 0.548}(0.92 - 0.77)$$

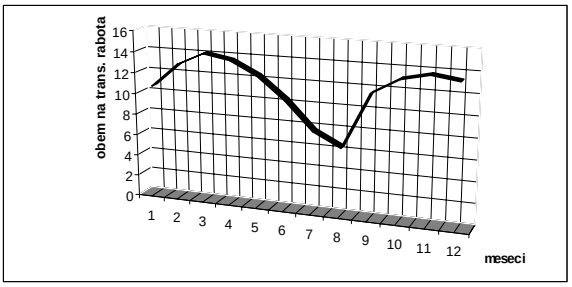
Месец	Обем на превоз во 000 pat.	Изминати километри во 000	Транспортна раб. во pkm x 10^6	ψ_{Qi}	ψ_{Ui}	$\alpha_t Q_i$	$\alpha_t U_i$	α_t
Јануар	7.620	1.397	10.645	0.942	0.913	0.859	0.852	0.855
Февруар	8.881	1.452	12.895	1.098	1.106	0.904	0.896	0.900
Март	9.293	1.518	14.106	1.149	1.210	0.919	0.920	0.919
Април	9.211	1.482	13.650	1.139	1.171	0.916	0.911	0.914
Maj	8.568	1.446	12.389	1.059	1.062	0.893	0.886	0.890
Јуни	7.755	1.334	10.345	0.959	0.0887	0.864	0.846	0.855
Јули	5.900	1.305	7.699	0.729	0.660	0.796	0.795	0.796
Август	5.165	1.239	6.399	0.638	0.548	077	0.770	0.770
Септември	8.253	1.409	11.628	1.020	0.997	0.882	0.871	0.876
Октомври	8.742	1.499	13.104	1.081	1.124	0.899	0.900	0.900
Ноември	8.855	1.546	13.689	1.095	1.174	0.903	0.911	0.907
Декември	8.798	1.515	13.328	1.088	1.143	0.901	0.904	0.903
ВКУПНО	97.046	17.142	139.882					

Starting from fact that factors of irregularities ψ_Q и ψ_U are not overlapped by time line, value for αt can be calculated by:

$$\overline{\alpha t} = \frac{\alpha t_{Qi} + \alpha t_{Ui}}{2}$$



Fg.2. Monthly irregularity in volume of passenger transport in 2004



Fg.3. Monthly irregularity in volume of performed transport job for 2004год.

During determining the number of necessary vehicles we must take in mind the influence of future availability of vehicles, density of exploitation and integral logistic support. To enable managing with the readiness of the vehicle park in real time, but in function to already installed and public announced driving time list it is necessary continuously to survey discreet random process which determines the condition of vehicle park on an view to readiness for perform the transport tasks. During that processes of change of technical condition of vehicles and process of technical service are simulated based on statistically determined value dependences for each time period.

That is the way to calculate dynamical value of factor of technical correctness of vehicles in vehicle park and update the transport ability of vehicle park with irregularities in volume of transport and transport job.

With it we achieve rhythm during workflow. Additional effects are achieved with correct planning the staff and other organizational measures

3. Conclusion

This paper is applied and model for establishing relationship between processes of change of technical condition at transport units and realized quality of technical service and maintenance as elements if logistic support, is checked . Input parameters are gathered from Public transport enterprise (JSP) – Skopje precisely from departments for exploitation and maintenance of vehicles in vehicle park.

Together with results of such established relationship we can come to conclusion that this model enable calculations to determine and later simulate conditions in the system on base of previously determined statistical laws. By that way prediction of availability of the system with available transport units is enabled, and total integral technical support of the maintenance system has possibility to raise to level which will enable highest technical correctness of transport units at maximal transport demands.

4. Literature

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