

## To Operation of the Uzte16m4 Diesel Locomotives on the Mountain Section of the Railway Track

**Oleg S. Ablyalimov**

*Candidate of technical sciences, professor,  
Tashkent State Transport University, Uzbekistan, Tashkent*

**Sherali I. Mamayev**

*Doctor of Philosophy in Technical Sciences (PhD), associate professor,  
Tashkent State Transport University, Uzbekistan, Tashkent*

**Anna N. Avdeyeva**

*Candidate of technical sciences, associate professor,  
Tashkent State Transport University, Uzbekistan, Tashkent*

**Dilnoza I. Nigmatova**

*Doctor of Philosophy in Technical Sciences (PhD),  
Tashkent State Transport University, Uzbekistan, Tashkent*

**Abstract:** The substantiation of the parameters of the main indicators of the transportation work of diesel locomotives UzTE16M4 on a real mountain section of the railway during the movement of freight trains without stops at intermediate stations is given. Numerical values of the indicated parameters and regression equations for their definition are obtained. The results of the study are recommended for the practice of the Karshi locomotive depot of the Uzbek railway.

**Key words:** efficiency, freight train, diesel locomotive, railway, tabular data, operation, graphical dependencies

Based on a comprehensive program for the development and modernization of the railway industry, the forecast for the expected average annual growth in freight traffic is 3.9 percent.

Currently, most of the freight traffic is organized by the diesel locomotive fleet, about twenty-eight percent of which, today, is carried out by UzTE16M main diesel locomotives in various sectional designs. This is confirmed by the diagram in Fig. 1[1], which characterizes the dynamics of the expected growth in freight turnover in billions of gross ton-kilometers, which is realized 55.6 percent of train diesel locomotives of the entire operating locomotive fleet of «Uzbekistan Temir Yollari» JSC.

Therefore, theoretical and experimental studies related to the substantiation of parameters, analysis and assessment of the fuel and energy efficiency of using the locomotive fleet of a railway company in real operating conditions will be very timely and relevant.

This paper presents the results of studies to evaluate the effectiveness of the use of diesel locomotives UzTE16M4 series on the real, mountainous section of Kumkurgan - Tashguzar of the Uzbek railway.

A distinctive feature of this railway is the conditionally "difficult" elements of the track profile, characterized by an abundance of protracted ascents and descents, the maximum steepness of which reaches + 20.7 ‰ and - 20.5 ‰, respectively [2].

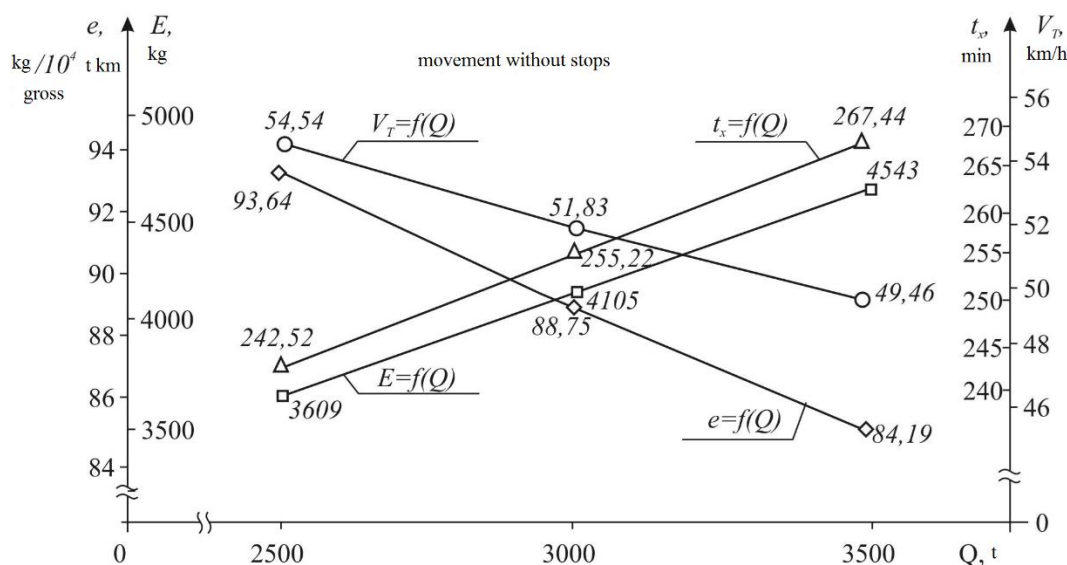
In table 1 is given the results of traction calculation for three different modes of movement of a freight train by *UzTE16M4* diesel locomotives on the section Kumkurgan - Tashguzar when moving without stops at intermediate stations, taking into account the differentiation of the mass of composition of train from  $Q_1 = 2500$  t to  $Q_3 = 3500$  t and a constant number of axles in the train, equal to  $m = 200$  axles.

In table 1 is given the conditions for organizing freight traffic and shows the main indicators of the transportation work of *UzTE16M4* diesel locomotives on the real, mountainous section of Kumkurgan - Tashguzar, taking into account the reduced total and specific cash costs, which are equivalent to the unit cost of rail transportation of goods and are directly related only to the consumption of full-scale diesel fuel for trains traction.

**Table 1. Indicators of the use of *UzTE16M4* diesel locomotives on the section Kumkurgan – Tashguzar**

Calculation option	Conditions by transportation works			Train time of movement, min			Diesel fuel of consumption			Money costs	
	of composition mass $Q, t$	number of axles $m$ , axles	technical speed of movements, $V_t$ , km/h	general $t_x$	in mode of traction $t_t$	in mode of idling and braking $t_{x+r}$	genera	specific		fulls $C_r$ , thousand soums	specific $C_r$ , thousand soums /km
							l	per trip $E$ , kg	of natural fuel $e$ , kg/ $10^4$ t km gross		
1	2	3	4	5	6	7	8	9	10	11	12
Movement on the hauls of the site without stops, $L = 220,450$ km											
1	2500	200	54,54	242,52	115,64	126,88	3609	65,48	93,64	6389,5	28,98
2	3000	200	51,83	255,22	132,17	123,05	4105	62,07	88,75	7267,7	32,97
3	3500	200	49,46	267,44	146,74	120,70	4543	58,87	84,19	8043,1	36,48

On fig. 1 shows the nature of the change in the main indicators works and the use of *UzTE16M4* diesel locomotives on the Kumkurgan - Tashguzar section, depending on the mass of the freight train during non-stop movement of train. The mass of the freight train composition varied with an interval of  $\Delta Q = 500$  t in the range from  $Q_1 = 2500$  t to  $Q_3 = 3500$  t with a constant number of axles in the train equal to  $m = 200$  axles.



**Figure 1. Dynamics of indicators of use of *UzTE16M4* diesel locomotives at the section Kumkurgan - Tashguzar of "O'zbekiston temir yo'llari" JSC**

According to table 1 and fig. 1, similarly to [1,3], regression equations were calculated to determine the parameters of the main indicators of the transportation process on the Kumkurgan - Tashguzar section, organized by diesel locomotives of the *UzTE16M4* series, together with a sufficient value of the approximation with reliability  $R^2=1.0$  (the necessary reliability condition is  $R^2 \geq 0.8$ ). Here, the factor (indicator)  $Q_i = 1,2,3$  denotes a variant of traction of calculation.

Total train of travel time  $t_x$ , min:

$$t_x = -0,24Q_i^2 + 13,42Q_i + 229,34 \quad (1)$$

Train of travel time on mode traction  $t_T$ , min:

$$t_T = -0,98Q_i^2 + 19,47Q_i + 97,15 \quad (2)$$

Train travel time on mode idling and braking  $t_{xx,T}$ , min:

$$t_{xx,T} = 0,74Q_i^2 - 6,05Q_i + 132,19 \quad (3)$$

Technical speed of movement  $V_T$ , km/h:

$$V_T = 0,17Q_i^2 - 3,22Q_i + 57,59 \quad (4)$$

Total consumption of natural diesel fuel per trip  $E$ , kg:

$$E = -29Q_i^2 + 30Q_i + 3055 \quad (5)$$

Specific consumption of natural diesel fuel  $e$ , kg/10<sup>4</sup> t km gross:

$$e = 0,105Q_i^2 - 3,725Q_i + 69,1 \quad (6)$$

Adjusted (Specific) cash costs, thousand soums/km:

$$c_T = -0,24Q_i^2 + 4,71Q_i + 24,51 \quad (7)$$

Thus, numerical values were obtained and the nature of the change in the parameters of the main indicators of the use of four-section main diesel locomotives *UzTE16M4* series depending on the composition mass of the freight train, which is described by a polynomial dependence of the second degree with one hundred percent calculation accuracy, was established.

The parameters of the main indicators of the transportation process of four-section mainline diesel locomotives *UzTE16M4* series in freight traffic will be useful for drivers - instructors and specialists of the operation shop of the locomotive depot Karshi, whose work is associated with the rationing of diesel fuel consumption on of train traction and with the development of regime maps for driving freight trains by *UzTE16M4* diesel locomotives at the Kumkurgan – Tashguzar section.

#### References:

1. Ablyalimov O. S. On the issue of operation of diesel locomotives *UzTE16M4* on the section Tashguzar - Kumkurgan SJSRC "Uzbekiston temir yo'llari" [Text] / O. S. Ablyalimov, V. S. Kudryashov, I. R. Kayumov // Republican Scientific and Technical conference with the participation of foreign scientists "Transport logistics, multimodal transportation". - Tashkent: TashIIT, 2012. - pp. 48-51.
2. Ablyalimov O. S. Fundamentals of locomotive management [Text] / O. S. Ablyalimov, E. S. Ushakov // Textbook for professional colleges of railway transport. - Tashkent: Davr, 2012. - 392 p.
3. Ablyalimov O. S. Study of the operation of diesel locomotives *4TE10M* on the section Kumkurgan - Tashguzar [Text] / O. S. Ablyalimov // Republican scientific and technical conference with the participation of foreign scientists "Resource-saving technologies in railway transport." - Tashkent: TashIIT, 2013. - pp. 54-57.