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Justification of the Efficiency of Using 4te10m Diesel Locomotives on the Kumkurgon – Tashguzor Section

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Abstract:

Introduced the results of the investigation of the energyly on evaluation of efficiency of the 4TE10M diesel locomotives on a mountainous road section of railway track by of the movement freight trains without and with stopping on through stations, passing - tracks and division points.

Keywords: investigation, cargo train, diesel locomotive, railway track, exploitation, the haul, analyses, the station, mountainous.

The purpose of this study is to determine and analyze the kinematic and energy performance indicators of mainline four-section diesel locomotives of the 4TE10M series when moving freight trains with the most common train mass Q = 3000 tons and a constant load on the wheelset axle equal to $q_0 = 15$ t/axle on the mountain section Kumkurgon – Tashguzor of the Uzbek railway, taking into account the traction quality of the profile of the path of this section of the railway.

The assessment of the difficulty (complexity) of each of the runs of the specified section of the railway will be carried out according to the given values of the total consumption of diesel fuel for

traction of trains and the mentioned consumption per unit of work of a locomotive, including a diesel locomotive, and not according to dimensionless (artificial) values [1], characterizing the true parameters of the path profile. The latter are assumed to be equal to the ratio of their magnitude to one kilometer of the length of the railway track, which we denote as an indicator (criterion), characterizing the complexity of the track profile, taking into account the cost of diesel fuel when freight trains move on this section.

To achieve the stated goal of the research, the author relies on the differential equation of train motion [1], which graphically solves and the initial parameters [2] of the 4TE10M diesel locomotives under study and the track profile of a given section of the railway.

The results of the numerical calculation of the kinematic parameters of the movement of a freight train of a fixed mass of the train and the number of axles on the Kumkurgon - Tashguzor section of the Uzbek railway are given in table 1, and in table 2 shows the energy indicators of transportation work for the 4TE10M diesel locomotives under study.

Table 1. **Distribution of travel movement time of a freight train along the route of rolling stock on the Kumkurgan – Tashguzar section**

No. in order	Hauls	Train movement time (without stops / with stops), min		
		by haul	in mode	
			of traction	of idling and braking
1	Kumkurgon - Tangimush	21,43/22,83	17,46/17,89	3,97/4,94
2	Tangimush - Baysun	43,31/46,13	39,48/40,44	3,83/5,69
3	Baysun - Derbend	22,16/23,61	13,22/13,54	8,94/10,07
4	Derbend - Shurab	16,57/17,65	12,27/12,57	4,30/5,08
5	Shurab - Aknazar	15,54/16,55	14,70/15,06	0,84/1,49
6	Aknazar - Acrobat	25,59/27,26	25,06/25,66	0,53/1,60
7	Acrobat - Dekhkanobod	59,26/63,11	4,11/4,21	55,15/58,90
8	Dekhkanobod - Tashguzor	51,36/54,71	5,87/6,02	45,49/48,69
	Kumkurgon - Tashguzor	255,22/271,85	132,17/135,39	123,05/136,46

Table 2. **Amount of diesel fuel consumed by 4TE10M diesel locomotives during the movement of a freight train along the Kumkurgon - Tashguzor section**

No. in order	Hauls	General by hauls E, kg Specific by hauls e, kg/10^4 t km	
		without stops	with stops
1	Kumkurgon - Tangimush	603,34/91,10	614,6/92,81
2	Tangimush - Baysun	1363,71/136,20	1389,3/138,76
3	Baysun - Derbend	466,42/75,32	475,9/76,91
4	Derbend - Shurab	399,47/166,44	406,9/169,56
5	Shurab - Aknazar	499,2/172,88	508,4/176,06
6	Aknazar - Acrobat	857,25/161,44	873,3/164,46
7	Acrobat - Dekhkanobod	226,53/14,40	230,7/14,67
8	Dekhkanobod - Tashguzor	271,98/16,01	277,1/16,31
	Kumkurgon - Tashguzor	4687,9/70,88	4776,2/72,22

Analysis of the data in table 1 suggests that when organizing freight rail transportation along the Kumkurgon – Tashguzor section, taking into account stops at intermediate stations, the following occurs:

- the train travel time on the route increases by 16.63 minutes, and technical speed movement is decreasing by 3.17 km/h with an average estimated time per one stop of approximately 2.08 minutes;
- the share of movement in mode tractions is 49.80 percent, and in idling and braking modes - 50.20 percent;
- the share of movement in mode traction decreases, and in idling and braking modes increases, respectively, by 1.99 percent in relation to the train travel time without stoppings at intermediate stations.

The nature of the differentiated distribution of diesel fuel consumption by the studied of 4TE10M diesel locomotives on the Kumkurgon – Tashguzor section in process movement of freight trains with a fixed mass of the train and stops at intermediate stations, taking into account indicator of the difficulty of the track profile of this section is shown in fig. 1, where the hauls are indicated: 1 - Kumkurgon - Tangimush, 2 - Tangimush - Baysun, 3 - Baysun - Derbend, 4 - Derbend - Shurab, 5 - Shurab - Aknazar, 6 - Aknazar - Acrobat, 7 - Acrobat - Dekhkanobod, 8 - Dekhkanobod – Tashguzor.

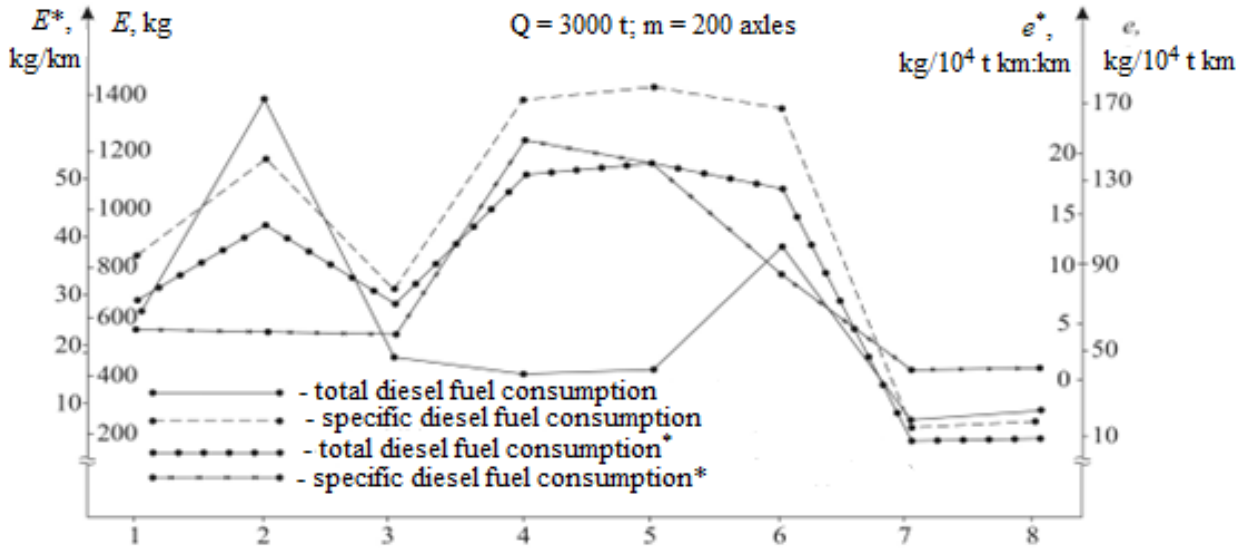

Figure 1. Changes in diesel fuel consumption of 4TE10M diesel locomotives on the Kumkurgon – Tashguzor section

Analysis of these research results allowed us to draw the following general conclusions.

1. The values of the parameters of some basic kinematic and energy indicators of the transport work of diesel locomotives 4TE10M on the Kumkurgon - Tashguzor section are substantiated:

- organization of railway transportation of goods with stops of freight trains at intermediate stations contributes to an increase in natural gas consumption diesel fuel by approximately 1.88...1.89 percent;
- driving freight trains with stops, in comparison with driving them without stops at intermediate stations, contributes to an increase in the total and specific consumption of diesel fuel by approximately 1.88 ... 1.89 percent;
- consumption of natural diesel fuel for one stop is 12.61 kg, and for one acceleration - braking, this consumption on average corresponds to 19.38 kg/stop.

2. Total amount of natural diesel fuel consumed per trip (E*, kWh/km)/specific (e*, W-h/t km: km) for each hauls of the Kumkurgon – Tashguzor section is:

- on the stretches Derbend - Shurab, Shurab - Aknazar and Aknazar - Acrobat, respectively 50.86/21.19, 52.82/18.29 and 49.34/9.29 2 units when the movement is with stops and 49, 93/20.80, 51.84/17.96 and 48 .43/9.12 units, in the case of non-stop traffic;
- on the Tangimush-Baysun haul - it will be 40.86/4.08 when moving without stops and 41.63/4.16 units when the movement is organized with stops at intermediate stations;
- on the other four hauls there is a fluctuation from 27.33/4.13 to 4.32/0.275 units. - movement without stops and from 27.84/4.20 to 4.40/0.28 units. movement with stops.

Thus, on the mountain section Kumkurgon - Tashguzor the most difficult hauls are Derbend - Shurab, Shurab - Aknazar and Aknazar - Acrobat, the Tangimush - Baysun hauls are moderately difficult, the relatively easy hauls are Kumkurgon - Tangimush and Baysun - Derbend, and the Acrobat - Dekhkanobod and Dekhkanobod - Tashguzor hauls are the easiest.

The results obtained are the basis for subsequent research related to the substantiation of the effectiveness of different types of locomotive traction in various conditions for the organization of freight transportation.

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