

Екіншіден, web сайтты пайдалану балалардың ақпараттық мәдениетін арттырады және бүкіләлемдік ғаламторды өзін-өзі тәрбиелеу үшін пайдалануға деген ұмтылысты дамытады.

Сондай-ақ, бұл сабақ барысында дәстүрлі дереккөздерде көрсетілгеннен гөрі кеңірек ақпаратты пайдалануға мүмкіндік береді.

«WCEIC» веб-сайтын әзірлеу барысында, веб-сайтты құру технологиялары бойынша теориялық материал және интерактивті веб-беттерді құруға мүмкіндік беретін заманауи веб-технологиялар талданылды. Әзірленген сайт барлық талаптарды қанағаттандырады. Веб-сайт жағымды түстермен безендірілген және қолданушы қолдана алатын көптеген мүмкіндіктерге ие.

Осылайша, балалар алған білімдерін қолданыстағы жобамен жұмыс жасау арқылы бекітеді, тек HTML беттерінен тұратын сайт пен жасалған сайт арасындағы айырмашылықтарды түсіне бастайды. Болашақта біз әзірлеген веб-сайтты нақты өмірде пайдалануға болады. Сондай-ақ, ұсынылатын қызметтер, жаңалықтар тізімін кеңейтуге болады. Бұл ресурс жұмыста тұрақты және онымен жұмыс істеу үшін жоғары білімді қажет етпейді. Web сайттарды қолдану оқу процесінің тиімділігін арттырады. Осылайша, әзірленген сайт балалардың танымдық оқу іс-әрекеттерін қалыптастыруға, оқу процесін жетілдіруге және дамытуға арналған тиімді құрал бола алады.

#### *Әдебиеттер*

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## AUTOMATION OF THE METHOD OF CALCULATION OF MAIN COMPARATIVE RESISTANCE TO MANEUVER TRAFFIC IN INDUSTRIAL RAILWAY TRANSPORT

Currently, a number of measures are being taken around the world for the efficient use of fuel and energy in industry. Shipments and standardization of fuel consumption of traffic units in the railway network are considered to be current issues.

In industrial railway transport, shunting operations are carried out mainly on high-slope and curved railways, in areas with dense arrowheads, and on the basis of decentralized electrical control. To minimize the fuel consumption of shunting locomotives, the calculations require an accurate calculation of the specific resistances acting on them. Several major scientists have proven that maneuvering flights with optimal methods at minimizing fuel consumption at railway stations gives the best results [1-3]. However, the maneuver based on the nature sheet of the train affects the composition of the movement the method of determining the principal specific resistances of average weight is not sufficiently automated.

It is known that information about the wagons on which the half-flight is performed is obtained from the nature sheet of the train. However, this form does not indicate the number of wagons and the amount of cargo loaded on them (net), ie not all the calculated parameters of the wagons. In order to calculate the basic specific resistance to the movement of the shunting structure in industrial railway transport in the research process <https://trainresapp.netlify.app/> site was created (Figure 1). Based on the number of wagons entering this site and the amount of cargo loaded on them (net), the following calculation parameters of wagons are determined:  $m$  - the total number of wagons transported,  $vag$  .;  $\Sigma q_n$  - total (net) weight of cargo in transported wagons,  $t$ ;  $\Sigma K_{ax}$  - total number of axles of transported wagons, ammunition;  $\Sigma q_t$  - total (container) weight of transported wagons,  $t$ ;  $\Sigma l_v$  - total length of transported wagons,  $m$ ;  $\Sigma q_{br}$  - gross weight of transported wagons,  $t$ ;  $\Sigma \bar{q}_{ax}$  - average weight of bullets from transport wagons,  $t$ .

Sanoat temir yo'llari transportida manyovr tarkibining harakatga asosiy solishtirma qarshiligi hisoblash uchun dastur

Vagon raqami:  Yuk og'irligi:      >

T/R	Vagon raqami	Yuk og'irligi	Vagon og'irligi	Vagon uzunligi	O'qlar soni	Umumiy og'irlik	O'qqa tushadigan og'irlik
1	24556544	50	24	14.73	4	74	18.5
2	29110327	12	29	18.8	8	41	5.12
3	29110327	12	29	18.8	8	41	5.12

Figure 1. Site data entry window designed to calculate the basic specific resistance to the movement of shunting structures in industrial railway transport

Determining the design parameters of wagons for shunting half-flights allows to calculate the specific resistance ( $w_0''$ ) of average weight to the movement of wagons.

It is known from [4] that, in accordance with applicable regulations, at railway stations  $w_0''$  To calculate the value of, the calculated parameters of the wagons are studied in 2 groups:

1. 4-axle wagons with a bullet weight greater than 6 t.
2. Wagons weighing less than 6 t and equal to the bullet.

The main specific resistance to the movement of locomotives, depending on the speed, is determined by the formulas [4]:

a) in traction mode

$$w_0' = 9,81 \cdot (a_0' + b_0' \cdot V + c_0' \cdot V^2), \text{N/t} \quad (1)$$

b) at idle

$$w_x' = 9,81 \cdot (a_x' + b_x' \cdot V + c_x' \cdot V^2), \text{N/t} \quad (2)$$

where  $B$  is the speed of movement, km/h (it is taken in the calculations at the beginning of the integration step);  $a$ ,  $b$ ,  $c$  - calculated coefficients with the corresponding indices, the values of which are taken from [4].

The main specific resistance to the movement of cars (on roller bearings) depending on the speed is determined by the formulas [4]:

1. For general-purpose freight wagons of 1520 mm gauge with gross weight per axle  $q_0 > 6 \text{ t}$

$$w'_0 = 9,81 \cdot \left(0,7 + \frac{a''_0 + b''_0 \cdot V + c''_0 \cdot V^2}{q_0}\right), \text{ N/t} \quad (3)$$

2. For general-purpose freight wagons of 1520 mm gauge with gross weight per axle  $q_0 \leq 6 \tau$

$$w'_0 = 9,81 \cdot \left(a''_{ox} + b''_{ox} \cdot V + c''_{ox} \cdot V^2\right), \text{ N/t} \quad (4)$$

If the train is formed from cars of different types, with different gross weight per axle, loaded and empty cars, the main specific resistance to the movement of cars is determined as a weighted average by weight according to the formula:

$$w''_0 = \frac{w''_0 \cdot Q_1 + \dots + w''_{0n} \cdot Q_n}{Q}, \text{ N/t} \quad (5)$$

where  $w''_0 + \dots + w''_{0n}$  - the main specific resistance to the movement of cars (with a different characteristic), N/t;  $Q_1 + \dots + Q_n$  - masses of train parts (cars), t (corresponding to certain);  $Q$  - mass of the train (wagons) total,  $\tau Q = Q_1 + \dots + Q_n$ .

The main specific resistance to the movement of the shunting structure on the developed site is calculated by formula (5) based on the calculated parameters of each wagon. In addition, Depending on the type of locomotive at the site, the number of wagons, the weight of the load on it, the description of the road, the environment and half-flights, the following resistance to the shunting structure identifies (Figure 2):

- ✓ specific resistance of slope;
- ✓ specific resistance of curvature;
- ✓ specific resistance of arrow conductors;
- ✓ specific resistance to low temperatures;
- ✓ specific resistance of wind acting in opposite and side effects;
- ✓ specific resistance of the road condition
- ✓ specific resistance when moving forward with wagons;
- ✓ basic and specific resistance to motion in gravity mode;
- ✓ basic and specific resistance to movement in salt walking mode.

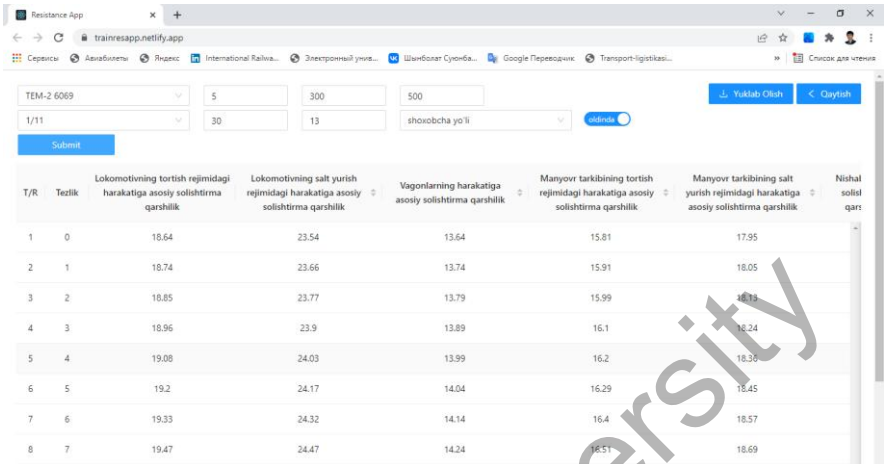


Figure 2. Site results window designed to calculate the basic specific resistance to the movement of shunting structures in industrial railway transport

Using the developed site and the current method, the specific resistance of the average weight to the movement of wagons in shunting structures was calculated (Fig. 3).

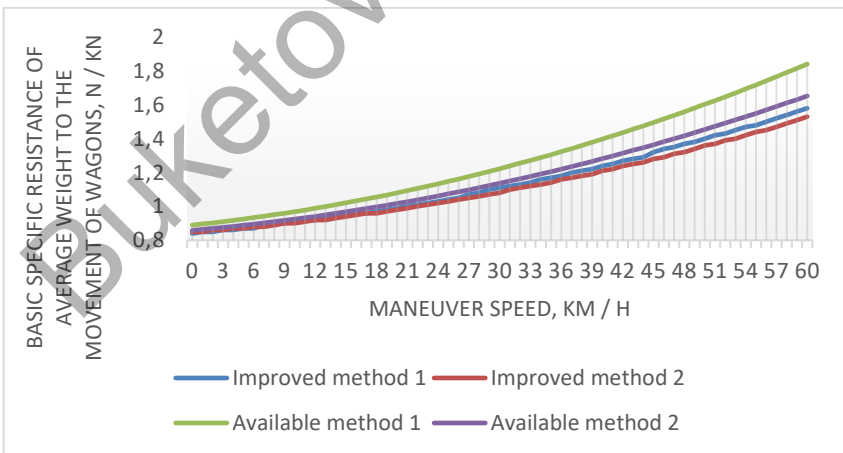


Figure 3. The results of the calculation of the specific resistance of the average weight to the movement of wagons in the shunting structure

As can be seen from Figure 3, the specific resistance of the average weight to the movement of wagons in the shunting structure calculated by the current method is always higher than the proposed method at speeds up to 60 km / h. Considering that shunting operations are mainly performed at speeds less than 60 km / h, it can be concluded that the time and amount of fuel spent on shunting operations calculated by the current method always gives more value than the actual amount.

In conclusion, it can be said that the amount of time spent on shunting half-flights is calculated correctly on the basis of traction calculations. determining the basic specific resistance of the average weight to the movement of the wagons is a complex task. The main reason for this is the presence of different wagons in the shunting structure and the calculation of the basic specific resistance of the wagons to the movement of wagons of average weight. 4-axle wagons weighing more than 6 t; 8-axle wagons weighing more than 6 t).

Using the above method and the developed site, all shunting vehicles are divided into 3 groups and the calculation of the average specific resistance to the movement of wagons of average weight allows you to accurately calculate the amount of time spent on shunting half-flights.

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