The Study of the Height of the Slide by Kinetic Energy Heights from Empty Cars

Shukhrat Saidivaliev, Samandar Sattorov and Diyora Juraeva

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THE STUDY OF THE HEIGHT OF THE SLIDE BY KINETIC ENERGY HEIGHTS FROM EMPTY CARS

PhD., associate Professor Sh.U. Saidivaliev,
Ph.D., S.B. Sattorov,
Student of Master's Degree, D.B. Jurayeva
Tashkent State University of Transport

The article uses analytical formulas derived from the application of the basic law of dynamics for non-ideal connections (the Dalembert principle), the calculation of the kinematic parameters of the carriage movement (acceleration, time, braking path) in the braking zone on the site of the first braking position of the sorting hump is performed

All over the world, it is becoming increasingly important to design and build modern sorting stations, as well as to choose the right height of sorting humps. The main function of the sorting hump at railway stations is the disbanding of trains, as well as the formation of new trains. Sorting will depend on how rationally the profile of the descending part of the hump is designed. Calculation of the height of the descending part of the hump and design work are carried out according to the existing method, according to which the movement of the car on the slope of the sorting hump, the speed is determined by the expression of the rate of fall of the car vertically, taking into account the inertia of the rotating masses. This, in turn, creates a number of problems. In developed countries, including the US, Germany, Sweden, China, India, Russia much attention is paid to the development of methods, such as mechanization and automation of sorting ways of stations that affect haul transport and local rail network [1-7].

The analysis of a number of works devoted to the study of the problems of calculating and designing the descent of the sorting hump shows that the mathematical model and calculation schemes for the movement of a single car on the slope of the hump have not been developed. In particular, the method of determining the time, path and speed of braking of the car on the section of braking positions has not yet been considered on a scientific basis. In this case, one of the actual practical issues of railway transport is the improvement of the method of calculating and designing the descent part of the sorting hump under the action of a longitudinal wind of small magnitude, based on the construction of a mathematical model of the movement of wagons in braking areas [10-17].

Measures are being implemented in the republic to develop transport systems, including the development of technologies that optimize and control the organization and management of processes for processing car flows at railway marshalling yards. Decree of the President of the Republic of Uzbekistan dated December 2, 2017 Resolution "on measures to diversify and develop foreign trade areas and improve transport infrastructure" where "... in the field of railway transport in general -improving the quality and safety of railway transport services, the construction of new railways, increasing the level of electrification of railways, ... creating the necessary conditions for the accelerated development of the railway network of the Republic of Uzbekistan." When performing these tasks, it is necessary to choose the optimal heights of the tops of marshalling yards, the development of a way to ensure a given norm of shock frequencies for standing groups of wagons is one of the important tasks.

The development and improvement of the work of marshalling yards is carried out in scientific centers, universities and research institutes of leading countries, including: University of Baltimore (USA), Technical University of Berlin (Germany), Swedish National Railway Administration (Sweden), St. Petersburg State Railway University (Russia), Russian Transport University (Russia), Ukrainian State University of Railway Transport (Ukraine), Tashkent State Transport University (Uzbekistan) [1,3,5,7,9,11,13-17].

An analysis of well-known scientific works on the dynamics of rotation of a wheelset of a wagon on the slope of a sorting hump allowed us to establish that, in accordance with the existing method, the same acceleration of gravity acts on the body both during vertical descent and when moving along an inclined plane.

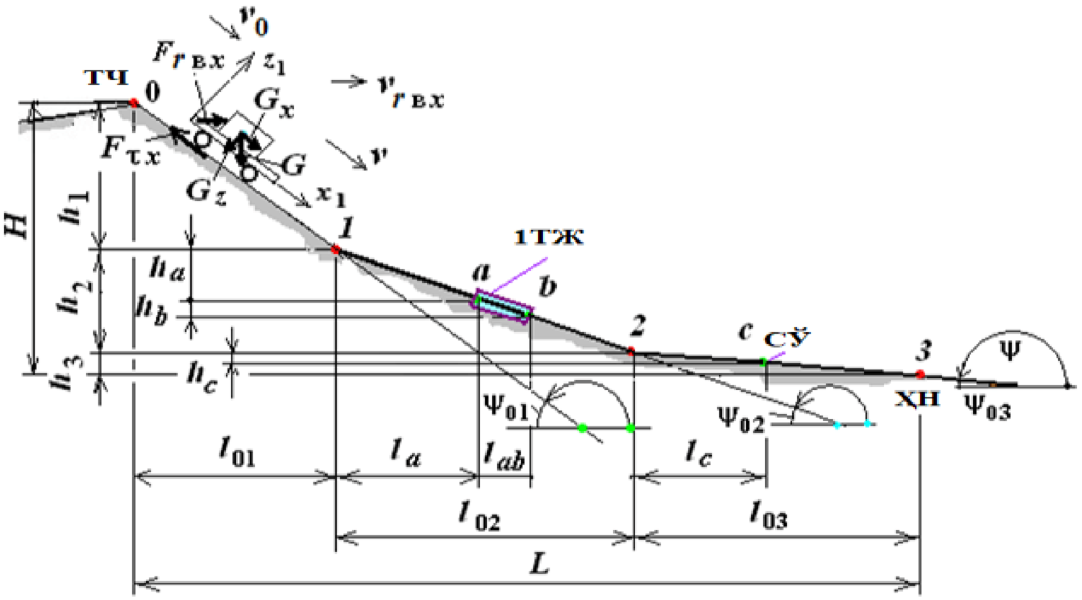


Figure 1.1. Calculation drawing of the descent of the vertex

In Figure 1.1, the sorting vertex is considered as consisting of 3 sections 0-1, 1-2 and 2-3 connected by two fault points 1 and 2. At the same time, in the second section 1-2 *a* and *b*, the first stop is located at (1BP), and in section 2-3 there is a switch zone (SZ) [2,4,6,8,10,12,14-17]. Also:

TH - the top of the hump;

N is the difference between the calculated point and the top of the hump on the underhill path, the most difficult under the conditions of rotation, m;

L is the estimated length of the hump (the distance from the top of the hump to the calculated point), m;

h_1, h_2, h_3, h_a, h_b, h_c and l_{01}, l_{02}, l_{03}, l_a, l_b, l_c - height and length of the legs arranged according to the sections of the hump, m;

l_{ab} – length of the first braking position (1BP), m;

ψ_{01}, ψ_{02} and ψ_{03} - the angle of inclination of the sections on the hump in accordance with, rad.;

G и G_x, G_z - gravity and its projection on the coordinate axis, N;

$F_{гвх}$ a $F_{\tau x}$ is the friction force and as an active force, the aerodynamic drag force in the longitudinal wind, n;

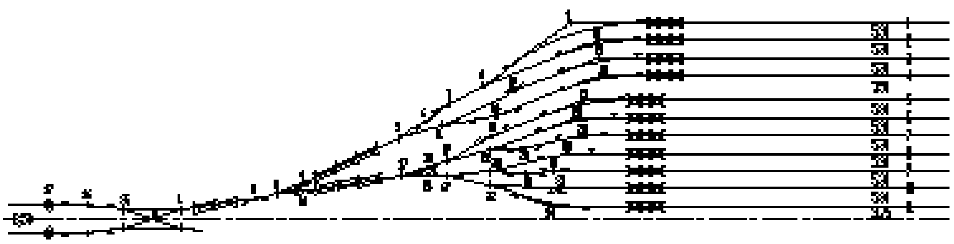
v_0 is the highest initial rotation speed of a very good runner (PB), mps;

v_{vx} is the projection of the wind speed horizontally (33 mps, which is less than the speed of the storm wind), mps.

An analysis of the work in this direction shows that when mathematically writing a dynamic model of the descent of a car from the top of the sorting, there are shortcomings in the interpretation of typical rules of theoretical mechanics.

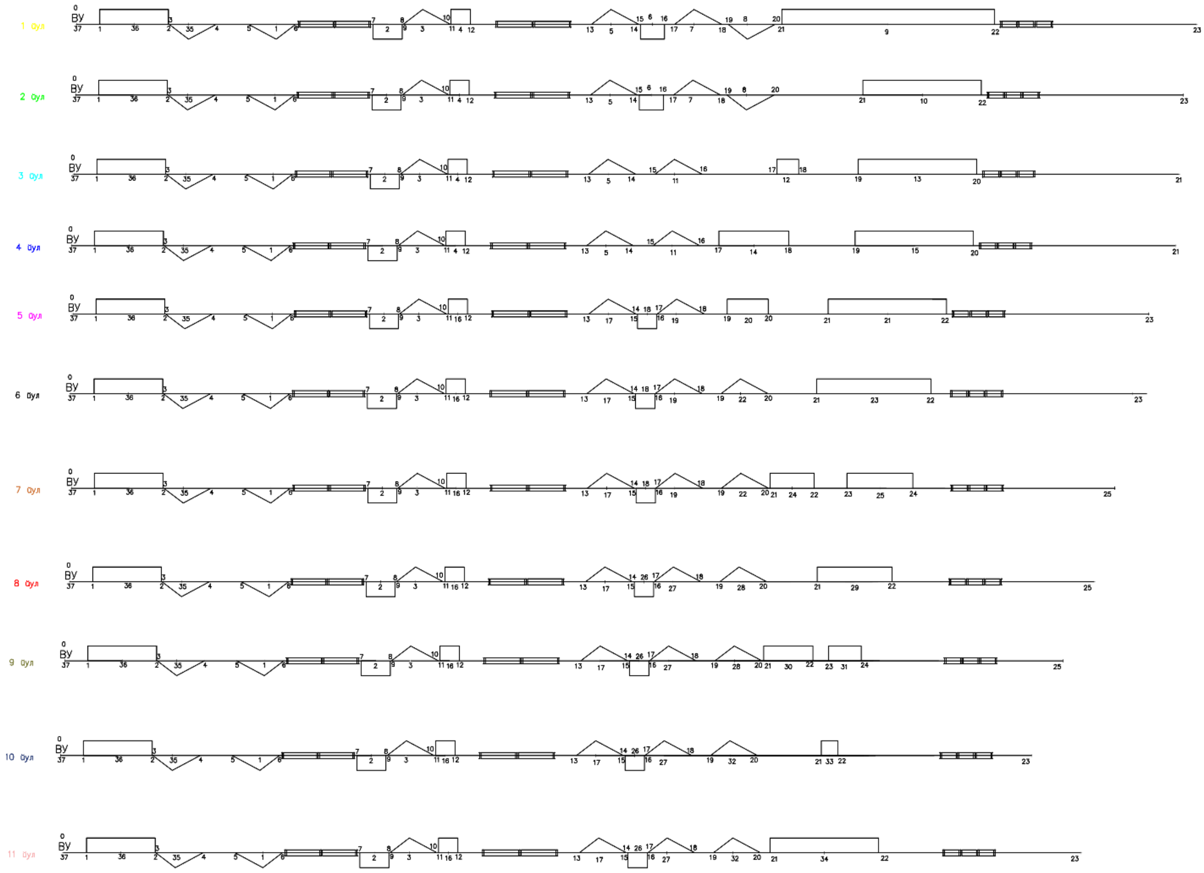
Mathematical recording of a dynamic model of the rotation of a wagon from a sorting hump, let's consider a visual example.

Winter temperatures are -10^0C, the headwind speed is 5 mps, and the weight of an empty covered wagon is 22 tons. According to the results of the calculation work using existing formulas to determine the height of the sorting hump H_t = 3.5 m. the number of paths of the sorting park is 22 paths.



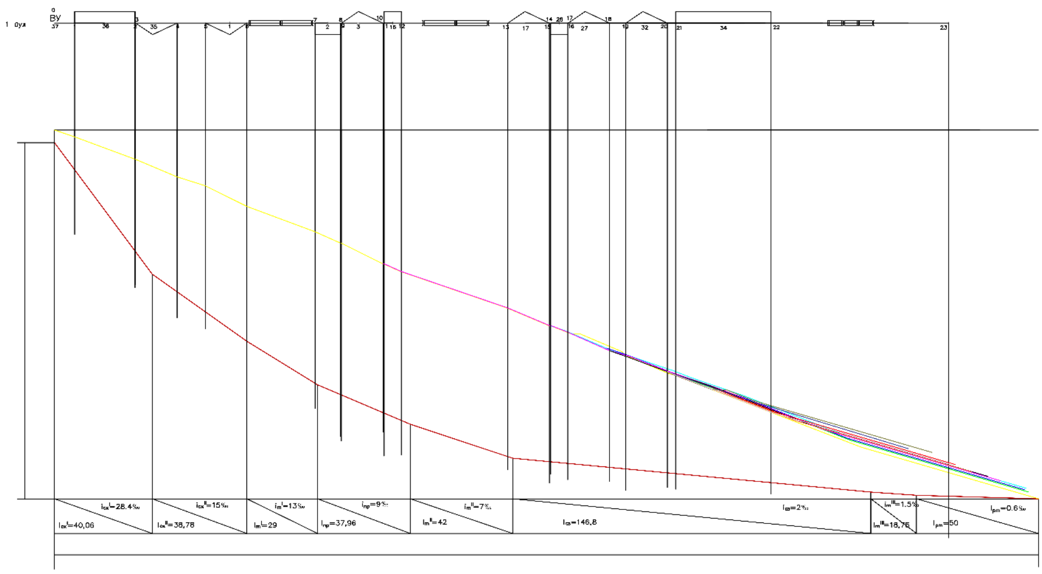
1.2. - drawing. The number of tracks in the sorting park is 22 tracks.

We design a 3.5-meter-high hump profile for the necks, where the sorting fleet consists of 22 tracks, based on the requirements of the norms and rules of railway construction. From the designed profile of the sorting hump, we build the height of the energy that will be lost for all tracks, dropping a bad runner (an empty covered wagon) for each track.



1.3.- Schemes of sorting paths.

The path diagram in Figure 1.3 includes the distances from the top of the hump (TH) to the calculated point (CP).



1.4.- drawing. Heights of energy loss descending cars from the sorting hill (on each segment of the way)

As can be seen from Figure 1.4. it can be seen that the height of the sorting hump, chosen for a difficult path, is high for the rest of the paths of the sorting park.

The speed of descent from the reception park to the sorting hump depends on the power of the sorting hump, it is accepted as for small power V_0 = 1.2 mps; for medium power V_0 = 1.4 mps; for large power V_0 = 1.7 mps. It is assumed that the requirement for cars with poor running when descending from the sorting hump should reach the minimum design point. It was recommended not to apply braking in relation to this car at a time when the car with a bad move is moving from the top of the sorting hill.

Conclusion

Analysis of the movement of an empty wagon in the profile of the sorting hump allows us to conclude that empty wagons dumped from the sorting slide on each track should be carried out by adjusting the speed of dissolution to the slide.

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