MAIN ISSUES TO BE RESOLVED IN ORGANIZING THE MOVEMENT OF PASSENGER TRAINS

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Abstract: This article briefly describes the mathematical model of passenger flow planning in railway transport. Also, the factors affecting the speed of trains are known, which can be divided into the classification of factors affecting fuel consumption and throughput. The speed of trains is directly related to the delivery time of goods. However, during transportation, the time spent by goods on trains is only one third of the delivery time. The remaining delivery time, including the time spent by goods at stations to perform technical and technological operations, is not directly related to the speed of travel. The speed of trains is studied in terms of maximum permissible, traffic, technical, section, route speeds. Speed, like all elements of the transport process technology, is divided into two types. One is regulatory and technological documents regulating the speed, and the second is their implementation. Currently, more attention is paid to the development of regulatory technological documents than to their implementation.

Keywords: Freight and passenger trains, empty containers, wind gusts, wind speed, aerodynamic pressure, sand drift, obstacles.

The following tasks are solved when organizing passenger train traffic:

- determination of the volume of passenger traffic taking into account the dynamics of promising development;
- selection of train weight, locomotive type, composition (scheme), speed of movement by train category;
- calculation of the optimal option of the train formation plan;
- determination of the volume of movement according to the category of passenger trains;
- choosing a scheme for stopping passenger trains based on the train running schedule;
- scheduling of train traffic with connecting passenger trains and freight trains;
- determination of the turnover of passenger trains that provide high indicators when using the train operating schedule and rolling stock;

- setting technical standards for passenger work and calculating indicators [1-10].

The volume of passenger flow is determined on the basis of reporting data from previous years, including Express data on the flow of passengers at large stations and reports on the number of passengers of the train. The disadvantage of such a calculation is that failures in passenger transportation are not taken into account. To determine the volume of passenger flow, it is advisable to conduct economic research in areas belonging to railway lines. On the basis of the analysis of passenger traffic, scheduled passenger flow schedules are developed, which indicate the number of passengers from each movement. Passenger flow diagrams are compiled from these tables. Since the volume of passenger flow in both directions, as a rule, is assumed to be the same, it is practically enough to draw up a diagram for one line [10-15].

Correlation analysis is used in volitional analysis of Transport volume. In this case, it is considered in 3 stages:

- drawing up a correlation equation in the general mathematical formula, which represents the nature of the relationship between the characters studied and the size of the passengers sent;
- solving the accepted model by finding the parameters of the correlation equation;
- assessment and analysis of the results obtained.

It allows you to draw the following conclusions based on their mathematical modeling by analyzing and interpreting the graph of changes in the indicators under consideration over time.

1. Changes in the volume of train flows are directly related to time, i.e.

$$Y = a_0 + a_1 \cdot t \quad (1)$$

Where: a_0, a_1-required dependency parameters;

t - is time, i.e. the ordinal number of the year.

2. The change in passenger flow volume is expressed as an inverse relationship over time:

$$Y = a_0 + a/t \quad (2)$$

3. Passenger flow volume is stable.

The second step, that is, the solution to the accepted correlation model, consists in finding the parameters of the correlation equations. The values of these parameters are determined using the least squares method, which means that in a rectangular coordinate system, the theoretical line must pass at the closest distance to the initial Real points. Otherwise, for all lines, the difference between the ordinal degrees and the sum of their squares would exist minimally [16-24].

The parameters of the degree are found by solving the following systems of equations:

$$a_0 n + a_1 \Sigma t = \Sigma Y \quad (3)$$

$a_0\Sigma t + a_1\Sigma t^2 = \Sigma Yt,\ a_0\Sigma t + a_1$ (4)

Where: y - is the actual levels of the indicator being analyzed;

N - is the number of levels.

Solving this system allows us to determine the parameters of the equation that is, the direct connection:

$a_0 = \Sigma Y/n, a_1 = \Sigma Yt/Yt^2,$ (5)

for the inverse relation:

$a_0 n + a_1\Sigma(1/t) = \Sigma Y$ (6)

$a_0\Sigma\cdot(1/t)+a_1\Sigma\cdot(1/t^2)=\Sigma Y\cdot(1/t).$ (7)

Solving the system gives the parameters of the inverse correlation equation.

$a_0 = \Sigma Y/n,$ $a_1 = \Sigma\cdot(Y/t/\Sigma\cdot(Y/t^2)$ (8)

Working templates are compiled for calculating parameters, on the basis of which the parameters of the necessary equations are determined. Parameters of each equation (indicator) 1-2 listed in tables,

a_0 =22411,3/5=4482,26 person.

a_1 =6883,1/10=688,31 person.

Table 1

Expected changes in passenger traffic on long-distance routes

Years	**Y**	***t***	***t²***	***t*Y**	***Ẏ***
2020	3340,6	-2	4	-6681,2	3793,95
2021	3060,7	-1	1	-3060,7	5170,57
2022	4446,5	0	0	0	4482,26
2023	6502,0	1	1	6502,0	3793,26
2024	5061,5	2	4	10123	3105,64
	Σ=22411,3		**Σ*t²*=10**	**Σ*tY*=6883,1**	**Σ*Ẏ*=22411,3**

The formula for calculating the expected volume of passenger traffic on long-distance routes is:

Ẏ(t)=4482,26−688,31·t

Expected volumes of passenger transportation on long-distance routes in 2025:

$\dot{Y}_T$ =4482,26−688,31·5=1040,71 person=1041 person

Table 2

Prospective changes in passenger flow in suburban transport

Years	***Y***	***t***	***t²***	***t*Y**	***Ẏ***
2024	17357,8	2	4	34715	16815,28
2023	15419,7	1	1	15419.7	14960,83
2022	11235,5	0	0	0	13106,38
2021	11447,0	-1	1	- 11447	11251,93
2020	10071,9	-2	4	- 20143,9	9397,48
	Σ=65531,9		**Σ*t²*=*10***	**Σ*tY*= -18544,5**	**Σ*Ẏ*=65531,9**

a_0 =65531,9/5=13106,38 person.

a_1 =18544,5/10=-1854,45 person.

The formula for calculating the expected volume of passenger transportation on suburban routes:

$\dot{Y}_T$=13106,38−1854,45·t.

Expected passenger traffic volume on suburban routes for 2025:

Y_T =13106,38–1854,45·5=3834,73·kishi.=3834 person

Analysis of these tables shows that the correlations are directly related and determine the growth of passenger traffic in the future. This can be explained by the following factors:

- increasing tariffs for ticket documents;
- launching high-speed electric trains and creating additional preferential ticket services, etc.

Based on the received passenger flows and a near-term analysis, passenger transportation planning for the coming period is carried out. This takes into account mass organized transportation events (exhibitions, sports competitions, relocation, conscription, etc.).

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