Elasticity coefficient for forecasting of the developing alternative routes results

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Abstract. This article represents the methodology of the transport flows elasticity in condition of two alternative routes. The planning of alternative routes demands the methodology of transport flows elasticity. As an example was taken one of the routes in Rostov-on-Don (Russia). A transport tunnel as alternative route was offered to redistribute transport flows. To assume transport flows behavior the elasticity coefficient was calculated. It showed the effect of tunnel implementation. Considering coefficient gives a clear idea if the implementation alternative route is efficient.

1 Introduction

High number of cars compromises quality of transport network function. It makes transport demand higher than transport network capacity. The economic indicators are affected. Alternative implementing of routes could be a solution for this problem. The effect of the implementation needs analyzing to avoid different risks. The planning of alternative routes demands the methodology of transport flows elasticity [1-3, 5-8, 12].

2 Theory

The transport elasticity coefficient could show changes by different factors. The negative sign of the elasticity coefficient is the opposite effect from the influencing factors in the studied process [3, 4, 9].

The coefficient of transport flows elasticity was offered, it can be obtained by:

$$\eta = \frac{Q_2^x - Q_1^x}{Q_1^x} \cdot \frac{P_2^y - P_1^y}{P_1^y}, \tag{1}$$

where η– coefficient of transport flows elasticity, $Q^x{}_1$, $Q^x{}_2$ – transport demand on the route X before and after developing alternative routes, $P^x{}_1$, $P^x{}_2$ – transport demand on the route Y before and after developing alternative routes.

It is better to use the cross elasticity coefficient for the forecasting the transport flows behavior in the two alternative routes conditions:

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$$\eta = \frac{Q_2^x - Q_1^x}{Q_2^x + Q_1^x} \cdot \frac{P_2^y - P_1^y}{P_2^y - P_1^y}, \quad (2)$$

where η – coefficient of transport flows elasticity, that could show changes by different factors, $Q^x{}_1$, $Q^x{}_2$ – transport demand on the route X before and after developing alternative routes, $P^x{}_1$, $P^x{}_2$ – transport demand on the route Y before and after developing alternative routes.

For better understanding the consequences of the developing new route, it is necessary to make a model of the situation.

Picture 1 shows four steps of it (figure 1):

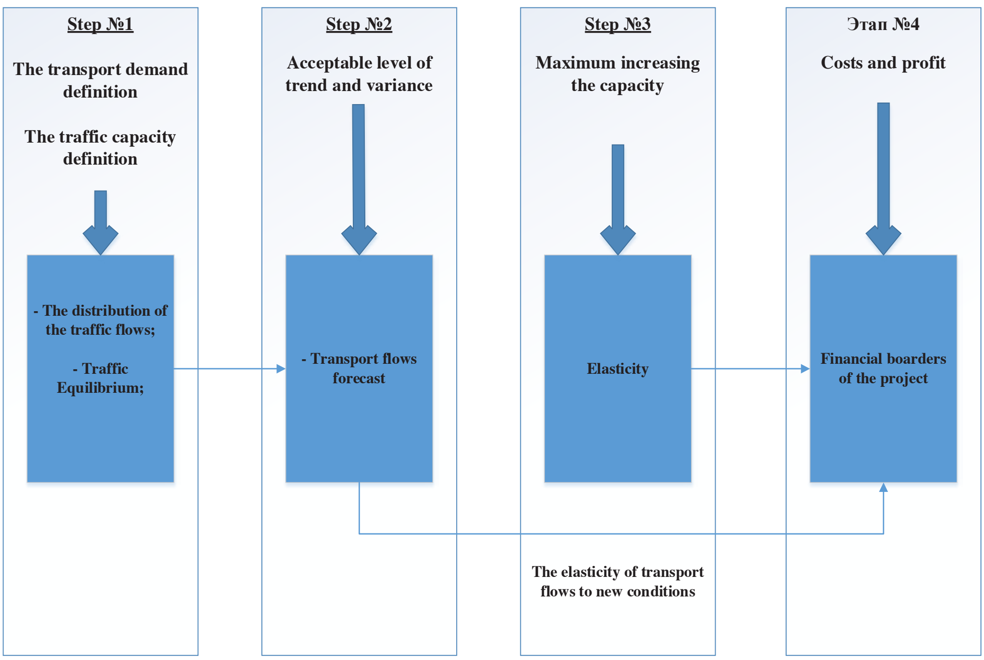

Fig. 1. The modelling of the new routes influence

3 Results and Discussion

For the modelling and utilizing the cross elasticity coefficient the data of the problematic part of Rostov-on-Don transport's network were studied (figure 2) [13, 14].

The modelling conditions had 2 scenarios: the first one is without alternative route, the second - redistribution of transport flows between two alternative routes. Pics. 3, 4 show: speed of transport flows in the first scenario is 26 km/h, in the second – 31 km/h, the increasing is about 19%. Also we got the transport demand increasing in 9% (figure 3-4).

The data show the positive effect of the developing the alternative route for this part of transport network. To receive the data about the transport flows redistribution, the cross elasticity coefficient was obtained. The results are (table 1,2).

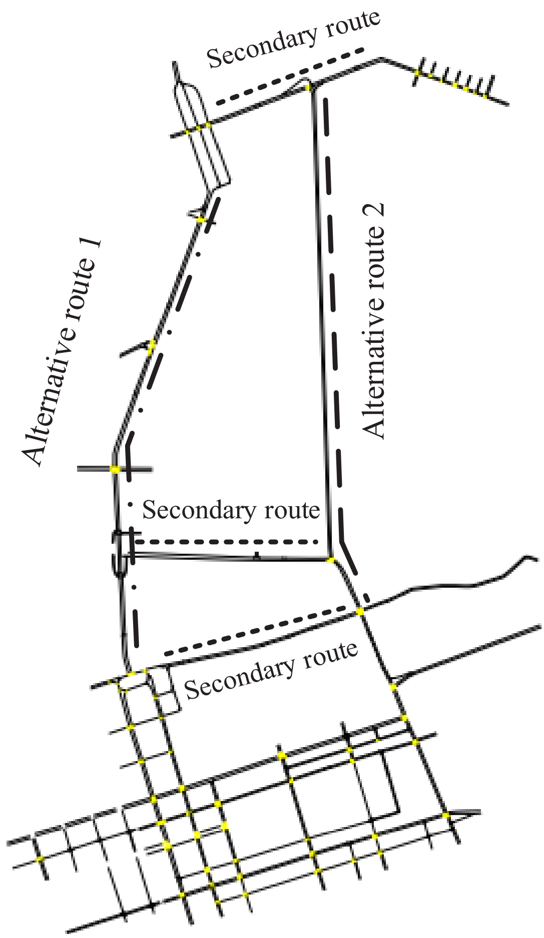

Fig. 2. The boarders of the modelling

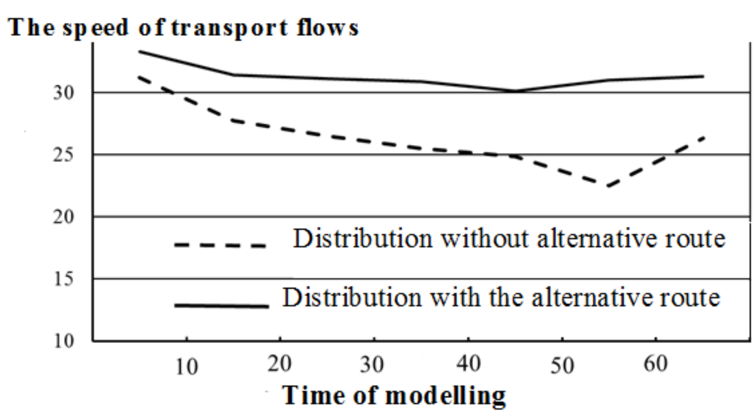

Fig. 3. The speed results of the modelling

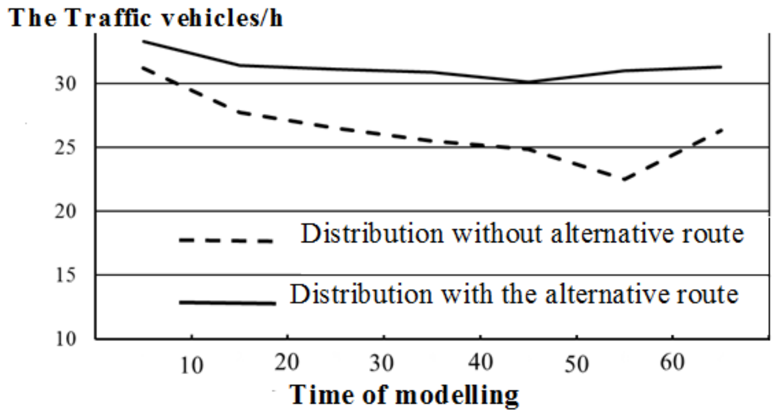

Fig. 4. The traffic results of the modelling

Table 1. The traffic flows redistribution

	Route code	Traffic (vehicles per hour)	
		Before developing alternative route	After developing alternative route
Alternative route 1	449	2592	1440
	451	738	209
	463	3204	1962
	490	1968	928
	491	3042	2027
	990	2208	1401
	2225	2310	1389
	2397	1488	521
Alternative route 2	2567	1716	2219
	2568	2178	2418

Table 2. Elasticity coefficient

Route code	Elasticity Coefficient
449	-0,429
451	-0,266
463	-0,558
490	-0,361
491	-0,571
990	-0,522
2225	-0,478
2397	-0,293

4 Conclusions

The elasticity coefficient we obtained is the important measure in the forecasting of the developing alternative routes.
On the base of modeling data, elasticity coefficient we got the results that make us sure in the successful developing of the project.

Many cities in the world get an experience in the developing alternative routes. Nevertheless, the results of such project are often unpredictable. The statistics shows that just in 24% of cases failed to shoot targets. Just 32% are successful. It means that it is necessary to find new approaches to solve this problem. The offered methodic could increase the successful results [10, 11, 15, 16].

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