

# METHODS TO CALCULATE URBAN TRANSIT TARIFFS

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## ABSTRACT

The paper presents a brief overview of pricing methods and considers the methodology for calculating tariffs for urban passenger transport in St. Petersburg. Based on the critical analysis, the author suggests own formula for calculating tariffs. It is based on the concept of social affordability of

prices and application of classification of costs by frequency of their occurrence, as well as through identification of the algorithm for calculation of the cost of travel. Tested version approximates the optimization of transportation costs and takes into account the interests of the budget of the city and passengers.

*Keywords:* urban passenger transport, pricing, cost classification, city carrier, calculation technique.

**Background.** Urban passenger transit is a socially oriented service that must necessarily take into account not only the citizens' demand for mobility of movement, but also the economic aspect of the travels. In other words, when calculating the fare, urban carriers should optimize their own costs to make travel safer and more comfortable.

**Objective.** The objective of the author is to consider the issue of calculation of city public transport tariffs.

**Methods.** The author uses general scientific methods, cost-based, market, normative-parametric economic methods.

## Results.

### 1.

In her work [1], A. S. Strinkovskaya notes that all prices present in our economy are closely interrelated. This is clearly shown in Pic. 1.

The price change in one of the blocks leads to their mandatory change in other blocks. So, the change in prices for fuel and energy resources – for example, fuel and lubricants – affects the tariffs of road transport enterprises and, ultimately, all consumers of transport services who pay for a trip or cargo transportation. Similarly, electricity tariffs affect the cost of electric transport services, and an increase in the price of freight transport entails an inevitable response in the prices of most goods.

At the same time, the quoted author [1] distinguishes three main functions of the state when regulating the transport services market and tariffs:

- ensuring general economic stability and proportional economic development;
- ensuring reasonable competition in individual markets;
- ensuring social balance.

In turn, M. B. Ermolaev and A. A. Borisova [2] distinguish three large groups of pricing methods:

1. Cost-based methods, including a method that takes into account the full costs of production of goods or services; method of direct (or marginal) costs; method of calculating prices on the basis of breakeven analysis.

2. Market methods, including the current price method; method of tender pricing; auction method of determining prices; a method based on finding a balance between costs and the state of the market.

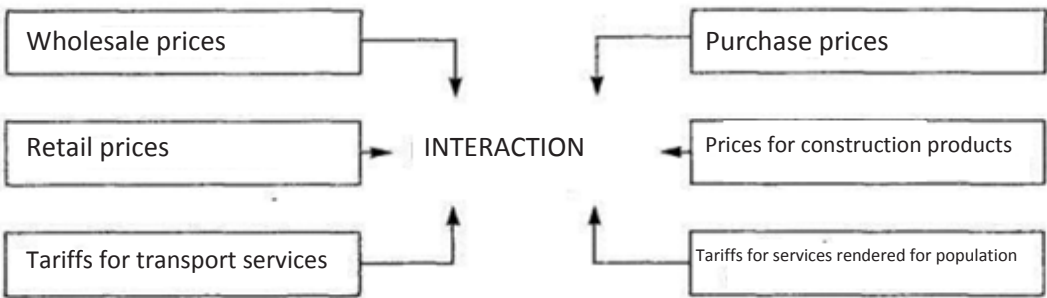
3. Normative-parametric methods, including the method of specific indicators; method of regression analysis; aggregate method; point method.

That is, today there are many different methods with which it is possible to calculate the cost of a product or a service.

Analysis of methods of tariff formation in transport has shown that when calculating tariffs for transportation by the regulatory bodies in St. Petersburg, the cost method (indexation of tariffs and method of economically sound expenses) is used.

Tickets are subject to indexation annually, and calculation of a tariff for travel is based on the method of economically sound expenses. The latter implies that all costs directly related to provision of passenger transportation services are added to a profit and divided by the number of passengers transported. The costs themselves are classified according to the calculation clauses, which include [3]:

- labor costs for main production personnel;
- deductions for social needs;



**Pic. 1. System of prices [1].**

Table 1

### Costs of the city carrier for 2018 year

No.	Elements of costs	Current costs, thous. rubles	One-time costs, thous. rubles				Total, thous. rubles
			Development of enterprise infrastructure	FIFA World Cup-2018	Additional transport safety	Recruitment to improve the level of mobility of passengers	
1	Material costs	10932599,97	823206,79	32815,12	9136,20	—	11797758,09
2	Labor costs	9799359,03	820906,62	42406,00	182633,90	127481,60	10972787,15
3	Deductions for social needs	2995985,01	245467,97	12679,38	54818,63	37889,03	3346840,02
4	Amortization	4192436,01	535639,92	23430,01	—	—	4751505,95
5	Other costs	6499181,04	393380,10	23634,50	39507,10	4462,90	6960165,64
Total costs, thous. rubles		34419561,06	2818601,41	134965,01	286095,83	169833,53	37829056,85
Non-operating expenses, thous. rubles							131235,60
Number of passengers carried, thous. people per year		732164,4	7542,00	3030,00	—	—	
Total, thous. people per year							742736,40

- costs for fuel, lubricants and maintenance materials;
- costs for restoration of wear and repair of automobile tires (for buses and trolleybuses);
- costs for repair and maintenance of vehicles;
- depreciation deductions;
- costs for leasing of fixed assets;
- other material costs;
- general production and general economic expenses.

According to the methodological instructions for calculating the fare for the journey, other expenses include those that are associated with transportation, are direct and not taken into account at other points. Such an approach, as it is not difficult to see, can indirectly urge city carriers to conceal specific costs in this article, because of which an artificial increase in the cost of travel can occur.

It has already been pointed out that the cost classification is carried out according to nine calculation clauses. And behind it there are several classification signs: by the way of inclusion in the production cost of production (direct and indirect (general production and general economic)) and by economic elements (material costs, labor costs, etc.). In our opinion, there is a confusion of the signs used and a situation is created in which the costs are not included in the cost groups or their duplication occurs, which directly affects the size of the fare.

Analysis of data of the city carrier allowed to conclude that in the period 2017–2018 there was a clear increase in material costs and labor costs. And in this case, we can talk about the emergence of capital costs, which were included in the fare along with the permanent.

## 2.

In our opinion, when calculating the fare for travel, it is necessary to classify all expenses of a city carrier through the prism of management accounting for the frequency of occurrence: that is, to divide into current and one-time; to spread the same costs for economic elements.

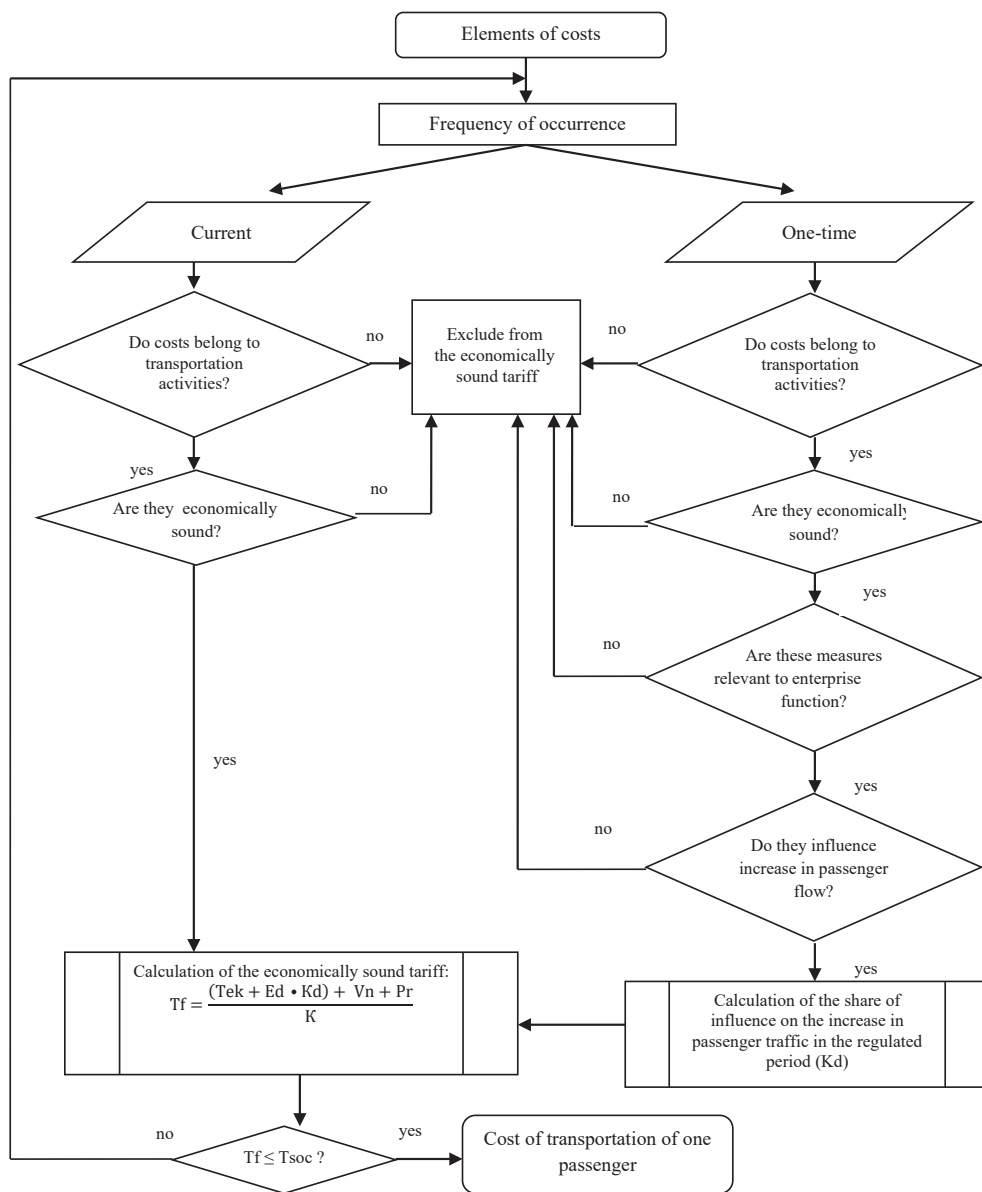
Such an approach has not previously been used in the sphere of passenger transportation, but it allows obtaining objective data on the costs incurred one-time, as well as assessing the appropriateness of including them in the tariff or subsidies from the city budget. Today it is considered that one-time costs should not be included in the cost price, as they are characterized by capital investments, but such an approach, in our opinion, cannot be called correct. In fact, non-recurring expenses are included in the cost of production of each calendar period according to the estimate-normalized calculations [4], i. e. to determine the amount of non-recurrent costs, it is necessary to compile a reasonable estimate for each organizational and technical measure. The identified costs are included in the corresponding articles of the planned cost [5].

In other words, the calendar period when regulating tariffs for urban passenger transport is one calendar year. When deciding on inclusion of non-recurrent costs in the fare, it is necessary to identify the share of costs that should be included in the cost price, taking into account how much these one-time investments affect the increase in passenger traffic in the regulated year.

Classification of costs by frequency of occurrence refers to the cost of managing costs, which is important in formation of tariffs in public transport.

Organization of management accounting is controlling, one of the main tasks of which is to ensure development of the enterprise on the basis of management of resources, costs and measurement of performance. The effectiveness of the enterprise, competitiveness in the market are largely determined by the extent to which cost management is rationally implemented [6].

After analyzing data of the city carrier, the author found out the one-time costs planned in 2018 and shared all the carrier's expenses in accordance with the proposed cost classification.



**Pic. 2. The algorithm of cost formation of a trip on urban passenger transport.**

Each of two groups of costs (current and one-time), as mentioned above, includes the same cost elements. Accordingly, to calculate the cost of travel, it is necessary to consider the costs of the city carrier, distributed according to the proposed methodology (see Table 1).

According to the methodology adopted in St. Petersburg for calculation of tariffs for urban passenger transport, the calculation formula includes all costs of a city carrier for transportation of passengers, including non-operating expenses, and looks as follows [3]:

$$T_g = \frac{(Z_g + Pr)}{Q_g}, \quad (1)$$

where  $Z_g$  – operational costs for transportation of passengers, rubles;  $Pr$  – expenses financed by

profit, rubles;  $Q_g$  – planned number of passengers carried, people.

The digitized version:

$$T_g = \frac{37960292,40}{742736,40} = 51,11.$$

In other words, the economically justified tariff for 2018 is 51,11 rubles for one trip. The difference between it and the tariff set for the population is subsidized from the budget of St. Petersburg.

### 3.

The author's position is that for today calculation of tariffs for urban passenger transport is not performed correctly, because according to all the rules of the economic theory, one-time costs cannot be fully included in the cost of products or services due to their specificity, irregularity and the degree of influence on the increase in passenger traffic.



Based on the above, the formula proposed by the author for calculating the cost of travel in urban passenger transport is as follows:

$$Tf = \frac{(Tek + Ed \cdot Kd) + Vn + Pr}{K}, \quad (2)$$

where  $Tf$  – tariff for travel;  $Tek$  – current costs;  $Ed$  – non-recurrent costs;  $Kd$  – coefficient of a share of costs;  $Vn$  – non-operating costs;  $Pr$  – profit;  $K$  – number of passengers carried.

The coefficient of a share of costs ( $Kd$ ) is a share of non-recurrent costs in increasing the number of passengers carried. So, according to the data in Table 1, only one-time costs for development of the company's infrastructure and the 2018 FIFA World Cup affect the increase in passenger traffic in the regulated period. But since, according to the author, the costs of events that are appropriate for the World Cup, must be fully funded by the city, they are subject to exclusion from the tariff, as well as the cost of recruiting staff to improve the level of mobility of passengers and ensure transport security.

In accordance with this approach, only a set of measures for development of the company's infrastructure should be included in the composition of non-recurring expenses and the cost-sharing ratio should be:

$$Kd = \frac{Ked}{K}, \quad (3)$$

where  $Ked$  – number of additional passengers at the expense of one-time costs in the calendar period;  $K$  – the number of passengers carried in the calendar period.

$$Kd = \frac{7542,00}{742736,40} = 0,01.$$

After calculating the coefficient of a share of costs, it is possible to proceed with calculation of an economically justified tariff according to the author's formula:

$$Tf = \frac{\left( \frac{34419561,07 +}{2818601,41 \cdot 0,01} \right) + 131235,60}{742736,40} = 46,56 \text{ rub.}$$

According to the calculations given above, the economically justified tariff was 46,56 rubles as compared with 51,11 rubles in 2018. At the same time, the tariff set for population in 2018 was 45 rubles [7], respectively, the difference between the economically sound and the established tariff (6,11 rubles) is covered by subsidies from the budget of St. Petersburg to maintain the financial sustainability of the city carrier.

However, the author's position leads to the fact that measures to optimize the costs of city carriers, based only on a change in the classification of costs, are insufficient for an objective and comprehensive consideration of the problem.

When setting tariffs for urban passenger transport, which is a socially-oriented service, it is necessary to take into account the financial possibilities of passengers, since when calculating the tariff, the total planned passenger traffic for the calendar period appears. There is a direct dependence: an overestimated tariff can adversely affect demand, thereby reducing the number of passengers, but at the same time, the decrease in the number of passengers affects the tariff level. In this case, it is necessary to maintain a balance of interests of all parties to transportation (carriers, passengers and authorities) so that the level of

passenger traffic either remains stable or increases. Then the carriers reduce the cost of transporting one passenger, the passengers themselves have the opportunity to travel in urban passenger transport at an affordable cost, and the authorities are not forced to subsidize unprofitable enterprises.

In short, there is a need to calculate a socially oriented tariff that would take into account the average income of citizens, the average number of monthly trips and the share of transport expenses in the total monthly income. The tariff for transportation of passengers should not exceed the socially oriented tariff ( $Tsoc$ ):

$$Tsoc = \frac{Zav.mon. \cdot Ur.trans.}{Kp.mon.}, \quad (4)$$

where  $Tsoc$  – socially oriented tariff;  $Zav.mon.$  – average monthly nominal wage;  $Ur.trans.$  – level of monthly transportation costs;  $Kp.mon.$  – number of monthly trips.

At the same time, the ordinary sense is that the tariff set for the population should be less or equal to the socially-oriented tariff:

$$Tf \leq Tsoc. \quad (5)$$

The number of monthly trips in 2018 is determined in the composition of the consumer basket and amounts to 619 trips per year or 51,6 per month [7].

According to Petrostat [city statistics office], the average salary of the townspeople in April 2017 was 53261 rubles/month. Given that the size of a single fare for travel in 2018 remained at the level of the tariff approved in 2017, then the named amount of wages can be taken into account. At the same time, the share of travel expenses in urban passenger transport averages 7 % of the monthly income [8]. And consequently, the calculation of socially-oriented tariff is carried out as follows:

$$Tsoc = \frac{53261 \cdot 0,07}{52} = 71,7 \text{ rub.}$$

In accordance with this value, the size of the economically justified tariff satisfies condition (5), it is less than the socially oriented tariff  $46,56 \leq 71,7$ .

Thus, accounting of transportation costs by a city carrier can be represented in the form of an algorithm in Pic. 2.

If at the input we have cost elements, then at the output – the cost of transportation, formed taking into account the classification of costs for one-time and current, as well as belonging to the regulated activities (that is, directly to passenger transportation, excluding the costs of unregulated activities). In addition, costs are analyzed for improving the quality of transportation and the responsibility of the city for carrying out certain activities in passenger transportation, which often should not be part of the tariff, but be subsidized by separate budget items.

In order to obtain the specified result at the output – a certain level of the cost of production, it is necessary to control the resource flows at the input of the system, that is, to monitor the elements of expenditure, to adjust their value within the specified limits [6].

The methodology presented in the article might make it possible to significantly reduce the economically justified tariff (that is, the prime cost of the trip) of the city carrier, and therefore, to reduce the subsidizing burden on the budget of St. Petersburg, to exclude the unreasonable increase in tariffs, make the journey more socially



accessible to passengers, and justify the costs of carriers, which they carry in the process of passenger transportation.

**Conclusion.** On the basis of the author's methodology, in the process of calculating the cost of travel, a classification criterion of costs is used based on the frequency of their occurrence (current and non-recurring), which helps to critically evaluate all elements of costs, analyze the need for certain activities, and eventually be able to calculate an economically justified tariff. The last moment significantly affects the reduction of subsidies from the city budget to cover the inter-tariff difference (that is, the difference between the cost of travel and the cost established by the authority).

The classification feature proposed by the author excludes duplication of costs in various articles, allows to see both current fixed costs and one-time costs, gives the regulator authority to exclude or accept certain costs depending on their exclusivity, social need and other factors that affect the growth of passenger traffic in the regulated period.

Thus, subsidizing unjustified expenses of enterprises is stopped, and the released financial resources can be directed to development of a multimillion city, the solution of socially important problems and tasks.

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