

# Ensuring the Needs of the Economy of the Far East in Railway Passenger Transportation

V.A. Podoba

Department of Economics,  
Far Eastern State Transport University,  
Khabarovsk, Russia

A.N. Kobylitsky

Department of Economics,  
Far Eastern State Transport University,  
Khabarovsk, Russia

A.V. Chudaev

Department of Economics,  
Far Eastern State Transport University

**Abstract**— This article supplies the population and the developing economy of the Far East in the passenger needs of transportation. The study estimated the condition of the passenger railway complex and the satisfaction of consumers in transport services. Perspectives of development and reforming of the passenger railway complex of the Far East Federal district are offered.

In addition, the author's approach to forecasting passenger turnover and revenues of suburban passenger companies, depending on the level of tariffs and the use of elasticity coefficients, is covered in this article. The usage of this technique allows to conclude contracts of transport services mutually acceptable to the customer and the contractor assessment of passenger turnover and revenues, as well as to establish a tariff that allows meeting the solvent demand of the population for suburban transportation. With the help of this technique, it is possible to calculate elasticity coefficients and forecast the size of passenger turnover and revenues of suburban passenger companies on this basis, as well as to allow the subjects of the Russian Federation and state institute in the sphere of public transport to form the parameters of contracts for public transport services on a scientific basis.

**Keywords**— *Passenger railway companies, suburban passenger companies, transport sufficiency, coefficient of elasticity, passenger turnover, passenger train rate, passenger train suburban rate.*

## I. RELEVANCE OF THE RESEARCH

Passenger railway transport has an important social and economic value playing a substantial role in life support of society and provides the constitutional right of citizens to move. Passenger rail transportation in Russia is unprofitable and needs subsidizing. In the course of structural reform of railway transport independent carriers were established for a long-range connection and suburban railway services. Suburban railway transportation provides labor mobility for the population, and in some regions suburban rail transportation is the only type of transport communication which provides an all-year-round connection of small settlements to the outside world [2,3,4,9,17,18,21].

Let's consider the prospects of reforming a passenger railway complex for a long-range connection and suburban railway services.

## II. RESEARCH PART

During reforming of railway transport (2001-2015) the main conceptual ideas about structural transformation of a passenger communication complex were not successfully realized in a full scale. In particular, there was the decision to refuse the establishment of territorial joint stock passenger companies. It led to the delay in development of market relations and competition in the sphere of long-range rail transportation at the regional level and especially such a remote one as the Far Eastern Federal District. Functioning of JSC "Federal Passenger Company" is characterized by high extent of centralization that does not allow the efficient response to changing conditions of the market and to consider specific features of its regional divisions [1,2,5,18].

Considering social value of railway passenger traffic, the state deliberately subsidizes passenger complex. Nevertheless, the efficiency of the measures cannot be fully provided without participation of regions in this process. For this purpose the authors considered and investigated various options of creation of joint stock companies for the transportation of passengers in long-range communication and/or the suburban rail service at the regional level. As a result of calculations, it is economically efficient to create a mixed independent passenger company for a long-range communication and the suburban rail services in the territory of the Far Eastern Federal District. As of successful operational practice of JSC "Passenger Company of Sakhalin", the efficiency of creation of a similar company will not raise any doubts in conditioning the support of regional authorities [1-6,8,11,17,19].

A distinctive feature of the Far East region is the impossibility of full refusal of suburban trains, due to the fact that automobile transport is not capable of satisfying the needs of the population in communication completely because of infrastructure restrictions and difficult climate conditions. During cooperation of JSC "Russian Railways" with the

regional authorities (according to the federal legislation ensuring suburban passenger rail transportation is in their competence) the heads of most regions agreed to compensate losses of railroad workers. Besides, the budgets of subsidized regions cannot afford such expenses [10,17,21].

The considerable problem of a suburban passenger complex resulted in a drop of passenger traffic and multiple growth of tariffs during 2008-2016 (see tab. 1). As a rule, there are disputes over an order of determination and coordination of volume of tariffs, income, passenger turnover and the amount of subsidies between the suburban passenger company JSC "Express of Primorye" and subjects of the Russian Federation, that leads to judicial proceedings. The authors made an attempt in the article to offer an approach to reasonable determination of volume of tariffs, income and a passenger turnover applying the elasticity coefficients. The estimations completed for the conditions of Khabarovsk Krai and the Jewish Autonomous Region allows a conclusion to be drawn on the possibility of the application of this method for the entire Far Eastern Federal District. The authors suggest to estimate dependence of a passenger turnover on the average value of a profit rate (that is, the value reflecting an average tariff) applying elasticity coefficients [12,13].

Table 1. Calculation of elasticity coefficients of a suburban passenger turnover depending on the size of a profit rate for the Far Eastern Federal District regions [21].

No.	Year	Passenger turnover, pax per km	Income, R	Profit rate, R./10 pax km	Elasticity coefficient
1	2008	942,3	474,5	5,04	-
2	2009	552,0	466,3	8,45	1,14
3	2010	398,0	469,2	11,79	0,25
4	2011	441,4	558,6	12,65	6,24
5	2012	383,8	494,9	12,90	2,89
6	2013	358,1	528,6	14,76	0,15
7	2014	346,3	506,9	14,64	0,39
8	2015	311,8	624,0	20,01	0,38
9	2016	297,0	662,3	22,30	0,42

The graphic analysis of passenger turnover dependency on a profit rate on the territory of the Far Eastern Federal District shows that power and hyperbolic dependences can be used for its mathematical description [12,13].

The parameters of passenger turnover dependency on profit rate were calculated with the standard tools of Microsoft Excel by the least squares method, we received parameters of hyperbolic and degree model (see tab. 2) [15,18].

The elasticity coefficient represents the relative rate of change of effective value in relation to factorial one [14,16]. For the chosen models it could be found by the following formula:

$$E = \frac{dy}{dx} \times \frac{x}{y} \quad (1)$$

Putting the parameters of degree and hyperbolic model in the formula, we receive (see tab. 2).

Table 2. Parameters of the functions describing dependence of a passenger turnover on an average profit rate

Type of function	Function	Coefficient of determination	Elasticity coefficient
power function $y=ax^b$	$y = 3002,6x^{0,777}$	$R^2 = 0,9506$	$E = -0,777$
hyperbolic function $y=a+b/x$	$y = 4251,9/x + 74,983$	$R^2 = 0,9814$	$E = -1/(0,0176x+1)$

Note: y — passenger turnover, mln pax km;

x — profit rate, R./10 pax km

Compared by the coefficient of determination hyperbolic function proves to be more fit (see tab. 2). The coefficient of elasticity of power function is average size and is of little benefit for justification of tariffs level, whereas the elasticity coefficient of hyperbolic function reflects the real economic value of dependence of a passenger turnover on the size of a tariff [12,13,14].

### III. CONCLUSIONS

Structural reform of railway transport did not automatically solve all the problems of passenger rail transportation. Federal subjects of the Russian Federation often withdraw themselves from the organization of passenger train traffic in the territory. The solution to the problems of passenger traffic can only be found in mutual efforts of regions, the railroad and the scientific community. One of the ways to reform a passenger complex is to create joint-stock carrier companies with the participation of regional authorities [1-7,20,22].

The suggested method of forecasting a passenger turnover and income with the help of elasticity coefficients can be used in a given suburban site or direction. Besides, the use of this technique will allow contracts on transportation services based on mutually acceptable estimation of passenger turnover and income both for customers and contractors, and also to establish a tariff which allows satisfaction of the solvent demand of the population of the Far Eastern Federal District for distant and suburban passenger traffic [12,13].

## References

- [1] Balandina, O.V. The research of efficiency of incorporating a railway passenger complex in the Far Eastern Federal District / O.V. Balandina: Dissertation Abstract ... D.Sc. / STU, Novosibirsk: 2011. – 24 pages.
- [2] Podoba, VA. Railway passenger complex of the Far East: problems and prospects: monograph/VA. Podoba, O.V. Balandina, A.N. Kobylitsky. – Khabarovsk: FESTU publishing house, 2011. – 95 pages.
- [3] Reforming of a passenger railway complex of the Sakhalin region / V.P. Ruban, V.A. Podoba, I.V. Achkasova, A.N. Kobylitsky//Economy of the railroads. – 2011. – No. 7. – Page 70-79.
- [4] Podoba, VA. Reforming of a suburban passenger complex of the Far Eastern Federal District/VA. Podoba, A.N. Kobylitsky//Economy of the railroads. – 2012. – No. 2. – Page 28-37.
- [5] Podoba, VA. Problems of reforming of a passenger railway complex of the Far Eastern Federal District/VA. The Podoba, O.V. Balandina, A.N. Kobylitsky//Development of economic science on transport: Collection of articles of I All-Russian scientific and practical conference (SPb on June 8-9, 2012) / edited by N.A. Zhuravlyova. SPb.: Petersburg State Transport University, 2012. – Page 71-73.
- [6] Kobylitsky, A.N. Formation of the market of transport services of the Far Eastern Federal District in the sphere of suburban rail transportation / Dissertation Abstract ... D.Sc. / FESTU, Khabarovsk: 2012. – 24 pages.
- [7] Trusting partnerships in a regulatory game: The case of suburban railway transport in Russia / Dementiev A., Loboiko A. / Research in Transportation Economics, 48 (2014), 209-220 p.
- [8] Kobylitsky, A. N. The current state, problems and the prospects of development of a railway passenger complex of distant following in Russia / A.N. Kobylitsky, A.A. Voprikova//Prospects of innovative development of the Russian economy at the present stage: Theses of All-Russian scientific and practical conference (on November 16, 2016) / edited by M.A. Nemchaninova. – Khabarovsk: FESTU publishing house, 2016. – 375 pages, Page 89-95.
- [9] Podoba, VA. Problems of transport service of the population of the Far Eastern Federal District by suburban railway transport and ways to solve them/VA. Podoba, A.N. Kobylitsky, L.A. Mikheyeva//Transport: science, equipment, management. 2015. No. 6. Page 15-19.
- [10] Podoba, VA. Problems and the prospects of development of rail passenger traffic in the Far Eastern Federal District of the Russian Federation/VA. Podoba, A.N. Kobylitsky//Development of economic science on transport: business optimization problem. collection of articles Digest of V International scientific and practical conference; edited by N.A. Zhuravlyova. SPb.: PSTU, 2016. Page 365-372.
- [11] Kobylitsky, A.N. Research of the market of passenger traffic in the territory of the Far East of Russia / A.N. Kobylitsky, A.A. Voprikova//Dynamics of relationship of various fields of science in modern conditions: collection of articles of the international scientific and practical conference: in 3 parts (on May 3, 2017) / edited by A.A. Sukiasyan. – Kazan: Publishing house: LLC “Omega of Science” (Ufa), 2017. – 244 pages. Part 1, pages 79-84.
- [12] Podoba, VA. Modern practice of tariff setting in suburban passenger traffic and a way of its improvement/VA. Podoba, A.N. Kobylitsky//Economy, innovations and scientific research in a transport complex of the region: problems and prospects of development: materials of All-Russian scientific and practical conference with international participation, October 27 / edited by A.N. Kobylitsky. – Khabarovsk: FESTU publishing house, 2017. – 319 pages, Page 234-237.
- [13] Kobylitsky, A.N. Research of elasticity of a passenger turnover in suburban railway communication / A.N. Kobylitsky//Transport: science, equipment, management. – 2018. – No. 2. – Page 31-34.
- [14] Nureev, R.M. Microeconomics: textbook / R.M. Nureev. – 2nd prod., amendment – M.: Norm: INFRA-M, 2012. – 576 pages.
- [15] Dougherty, Christopher Introduction to econometrics / Christopher Dougherty. – New York ; Oxford : Oxford univ. press, 1992. – XII, 399 p.
- [16] McConnell C., Brue S., Flynn S. Economics / McGraw-Hill/Irwin – 2008, 916 p., 18th Edition
- [17] Schneider, M.A. Market of suburban rail transportation. Management and economy: Monogr. / M.A. Schneider, E.A. Proskuryakova. – SPb.: LLC “NP-Print Printing House” publishing house, 2012. – 288 pages.
- [18] Economical and mathematical methods and models in management/A.C Pelikh, L.L. Terekhov, L.A. Terekhova. – Rostov “Phoenix”, 2005. – 248 pages.
- [19] Economy of passenger transport: a textbook for bachelors / edited by V.A. Persianov. – 2nd iss., – Moscow: “Knorus”, 2014. – 390 pages.
- [20] Concept of development of railway suburban passenger traffic: Approved by the Order of the Government of the Russian Federation of May 19, 2014. No. 857 // Legal-reference system “Consultant Plus” [An electronic resource] / the Consultant Plus Company Access mode: <http://www.consultant.ru>.
- [21] Card of the JSC “Express Primorya”//Center for disclosure of corporate information CJSC Interfax News Agency [An electronic resource] – Access mode: <http://www.e-disclosure.ru>
- [22] The annual report of JSC “Russian Railways” for 2015//Center for disclosure of corporate information CJSC Interfax News Agency – Access mode: <http://www.e-disclosure.ru>