

# JOURNAL OF TRANSPORT



ISSUE 1, 2025 vol. 2

E-ISSN: 2181-2438

ISSN: 3060-5164



RESEARCH, INNOVATION, RESULTS



**TOSHKENT DAVLAT  
TRANSPORT UNIVERSITETI**

Tashkent state  
transport university



**JOURNAL OF TRANSPORT**

RESEARCH, INNOVATION, RESULTS

**E-ISSN: 2181-2438**

**ISSN: 3060-5164**

**VOLUME 2, ISSUE 1**

**MARCH, 2025**



[jot.tstu.uz](http://jot.tstu.uz)

# TASHKENT STATE TRANSPORT UNIVERSITY

## JOURNAL OF TRANSPORT

SCIENTIFIC-TECHNICAL AND SCIENTIFIC INNOVATION JOURNAL

VOLUME 2, ISSUE 1 MARCH, 2025

**EDITOR-IN-CHIEF**

**SAID S. SHAUMAROV**

*Professor, Doctor of Sciences in Technics, Tashkent State Transport University*

**Deputy Chief Editor**

**Miraziz M. Talipov**

*Doctor of Philosophy in Technical Sciences, Tashkent State Transport University*

---

The “**Journal of Transport**” established by Tashkent State Transport University (TSTU), is a prestigious scientific-technical and innovation-focused publication aimed at disseminating cutting-edge research and applied studies in the field of transport and related disciplines. Located at Temiryo‘lchilar Street, 1, office 465, Tashkent, Uzbekistan (100167), the journal operates as a dynamic platform for both national and international academic and professional communities. Submissions and inquiries can be directed to the editorial office via email at [jot@tstu.uz](mailto:jot@tstu.uz).

The Journal of Transport showcases groundbreaking scientific and applied research conducted by transport-oriented universities, higher educational institutions, research centers, and institutes both within the Republic of Uzbekistan and globally. Recognized for its academic rigor, the journal is included in the prestigious list of scientific publications endorsed by the decree of the Presidium of the Higher Attestation Commission No. 353/3 dated April 6, 2024. This inclusion signifies its role as a vital repository for publishing primary scientific findings from doctoral dissertations, including Doctor of Philosophy (PhD) and Doctor of Science (DSc) candidates in the technical and economic sciences.

Published quarterly, the journal provides a broad spectrum of high-quality research articles across diverse areas, including but not limited to:

- Economics of Transport
- Transport Process Organization and Logistics
- Rolling Stock and Train Traction
- Research, Design, and Construction of Railways, Highways, and Airfields, including Technology
- Technosphere Safety
- Power Supply, Electric Rolling Stock, Automation and Telemechanics, Radio Engineering and Communications
- Technological Machinery and Equipment
- Geodesy and Geoinformatics
- Automotive Service
- Air Traffic Control and Aircraft Maintenance
- Traffic Organization
- Railway and Road Operations

The journal benefits from its official recognition under Certificate No. 1150 issued by the Information and Mass Communications Agency, functioning under the Administration of the President of the Republic of Uzbekistan. With its E-ISSN 2181-2438, ISSN 3060-5164 the publication upholds international standards of quality and accessibility.

Articles are published in Uzbek, Russian, and English, ensuring a wide-reaching audience and fostering cross-cultural academic exchange. As a beacon of academic excellence, the "Journal of Transport" continues to serve as a vital conduit for knowledge dissemination, collaboration, and innovation in the transport sector and related fields.

## Development of a forecasting model of the change in the volume of international cargo transportation in automobile transport

F.B. Khudaynazarov<sup>1</sup> <sup>a</sup>

<sup>1</sup>School for advanced strategic analysis of the Republic of Uzbekistan, Tashkent, Uzbekistan

**Abstract:** This article analyzes the changes in international freight traffic in road transport and predicts the changes in the results in subsequent periods using the least squares method. At the same time, the developed linear model is checked for reliability using the criteria of mean absolute deviation, mean square deviation, variability and correlation coefficients, the changes in export-import volumes are predicted in 2025-2027, and the necessary recommendations are developed.

**Keywords:** international transportation, systems analysis, export-import cargo, road transport, linear function, time series, least squares method, model, forecasting

## Avtomobil transportida xalqaro yuk tashish hajmi o'zgarishining prognozlash modelini ishlab chiqish

Xudoynazarov F.B.<sup>1</sup> <sup>a</sup>

<sup>1</sup>Strategik tahlil va istiqbolni belgilash oliy maktabi, Toshkent, O'zbekiston

**Annotatsiya:** Ushbu maqolada avtomobil transportida xalqaro yuk tashish hajmi o'zgarishi tahlil etilgan va natijalarni keyingi davrlardagi o'zgarishlari eng kichik kvadratlar usuli yordamida bashorat qilingan. Shu bilan birga, ishlab chiqilgan chiziqli modelini o'rtacha mutloq og'ish, o'rtacha kvadratik og'ish, o'zgaruvchanlik va korrelatsiya koeffitsiyentlari mezonlari yordamida ishonchlikka tekshirilgan, 2025-2027 yillarda eksport-import xajmining o'zgarishi bashorat qilingan hamda kerakli tavsiyalar ishlab chiqilgan.

**Kalit so'zlar:** xalqaro tashish, tizimli tahlil, eksport- import yuklar, avtomobil transporti, to'g'ri chiziqli funktsiya, vaqli qatorlar, eng kichik kvadratlar usuli, model, bashoratlash

### 1. Kirish

Yuklarni xalqaro tashishda transport xizmati bozorining shakllanishi milliy xususiyatlarini O'zbekistonning hamda dunyoning ko'p davlatlaridagi xalqaro yuk tashish bo'yicha mavjud quyidagi uchta guruh aniqlab berdi:

- eksport-import tashishlar (aniq bir davlatda);
- xalqaro tranzit;
- yuklarni chet el tashuvchilari orqali tashish.

Bu guruhlar orasidagi printsipial farqlar yuklarni yetkazishdagi transport-texnologik sxemalarda, transport-ekspeditsiya xizmatlarini tashkil qilishda, tashish uchun pul to'lash va ushbu jarayon qatnashchilarining o'zaro hisoblashuvlarida ko'rinadi.

Ulardan eng muhimi – yuklarni yetkazishdagi transport-texnologik sxemalarining huquqiy va moliyaviy-iqtisodiy jihatlarni farqlab beradigan guruhlar hisoblanadi.

Masalan, eksport-import tashishlarda yuk jo'natuvchi va yuk qabul qiluvchi yukni eksport yoki import qiluvchi davlat hududida, (masalan, O'zbekistonda yoki dunyoning har qanday davlatida) bo'ladi. Bu holda xalqaro aralash yuk tashishlar murakkab bo'lib, bir necha transport turlari qatnashadi [1].

### 2. Tadqiqot metodikasi

Avtomobil transportida yuklarni xalqaro tashishda tadqiqotlar va tahlillar qilib, ular asosida olib borilgan ko'rsatkichlarni bashoratlash modeli ishlab chiqiladi. Bu berilgan vaqt qatorlarini tahlil qilish orqali amalga oshiriladi. Xususan, vaqli qatorlarni eng kichik kvadratlar usuli bilan silliqlash ko'proq tarqalgan usullardan hisoblanadi [2].

Bunda hisobdagi kvadratlar yig'indisining og'ishmasi haqiqiyisiga nisbatan minimal bo'lishi kerak.

$$\sum_{i=1}^n (y_i - \hat{y}_i)^2 \rightarrow \min (i = 1, 2, \dots, n) \quad (1)$$

Bu yerda  $y_i$  vaqli qatorning haqiqiy qiymati.

Ijtimoiy – iqtisodiy statistikada vaqli qatorlarning analitik holatini aniqlashda asosan to'g'ri chiziqli funksiyalardan foydalaniladi [2]:

Berilgan vaqli qatorni silliqlashda to'g'ri chiziqli funksiyadan foydalanildi [3,4].

To'g'ri chiziqli funktsiya asosida berilgan vaqli qatorni silliqlash tenglamasi quyidagi ko'rinishga ega:

$$\hat{y}_t = a_0 + a_1 t \quad (2)$$

Bu yerda:  $\hat{y}_t$  - natijalik ko'rsatkich;

$a_0$  — boshlang'ich qatorni silliqlangan hisobli darajasi;

$a_1$  - aniqlanishi kerak bo'lgan o'zgaruvchan ko'rsatkich;

$t$  - mustaqil o'zgaruvchi.

 <https://orcid.org/0009-0005-7908-8061>



To'g'ri chiziqlik funksiyaning eng kichik kvadratlar usuli asosida quyidagi tenglamalar sistemasi asosida hisoblanadi.

Eng kichik kvadratlar usuliga muvofiq to'g'ri chiziqning bog'liq o'zgaruvchilari quyidagi tenglamalar sistemasi yechimidan topiladi. Hisoblash modelini ishlab chiqish uchun 1-jadvaldan foydalanamiz, bunda boshlang'ich bekatdan oxirgi bekatga borish jarayonidagi yo'lovchilar oqimi o'rganiladi [5,6].

1-jadval

To'g'ri chiziqlik funksiya yordamida hisoblash modelini ishlab chiqish

T / r	Yillar	$y_t$	$t$	$t^2$	$t^3$	$y_t t$	$y_t t^2$	$\hat{y}_t$
1	2012	6179,2	-6	36	1296	-37075,0	222449,9	6839,7
2	2013	6916,9	-5	25	125	-34584,5	172922,4	6825,3
3	2014	7732,4	-4	16	64	-30929,4	123717,7	6900,5
4	2015	8026,3	-3	9	27	-24078,8	722365	7065,2
5	2016	6637,8	-2	4	8	-13275,7	265514	7319,4
6	2017	7013,3	-1	1	1	-7013,3	7013,3	7663,2
7	2018	8007,5	0	0	0	0,0	0,0	8096,6
8	2019	8479,2	1	1	1	8479,2	8479,2	8619,4
9	2020	8762,3	2	4	8	17524,6	35049,3	9231,8
10	2021	10412,3	3	9	27	31237,0	93710,9	9933,8
11	2022	11901,3	4	16	64	47605,4	190421,5	10725,3
12	2023	10892,4	5	25	125	54462,0	272309,8	11606,3
13	2024	12443,2	6	36	216	74658,0	447954,2	12576,9
Jami		113404,1	0	45	50	87010,5	1672815,9	113403,4

Noma'lum parametrlarni aniqlash uchun normal tenglamalar tizimi  $a_0, a_1$  va  $a_2$  quyidagicha yoziladi:

$$\begin{cases} Na_0 + a_1 \sum t = \sum y; \\ a_0 \sum t + a_1 \sum t^2 = \sum yt; \end{cases} \quad (3)$$

Bu yerda  $y$  - berilgan qatorning darajasi;  $N$  - qatorlar soni;

Agar  $t$  ning toq darajalar yig'indisi nolga teng ( $\sum t = 0$ ) bo'lsa, butun tizimni ancha soddalashtirish mumkin:

$$\begin{cases} Na_0 + a_1 \sum t = \sum y; \\ a_0 \sum t + a_1 \sum t^2 = \sum yt; \end{cases} \quad (4)$$

Bunda:

$$a_0 = \frac{\sum y}{N}; a_1 = \frac{\sum yt}{\sum t^2}, \quad (5)$$

Tadqiqotda avtomobil transportida xalqaro yo'nalishlarda yuk tashish hajmlari 2012 – 2024 yillar mobaynida tashilgan eksport – import tashuvlari hajmi

tanlab olindi va ushbu yuk oqimi o'zgarishi yillar bo'yicha va keyingi yillar uchun prognozi ko'rib chiqildi [7,8].

Olingan ma'lumotlar asosida yordamchi jadval tuzib (2-jadval) tenglamalar sistemasini va hisoblash modeli aniqlandi.

$$\begin{cases} 13a_0 = 113404,1 \\ 182a_1 = 87010,5 \end{cases}$$

Parametrlar:

$$a_0 = \frac{113404,1}{13} = 8723,389; a_1 = \frac{87010,5}{182} = 478,08$$

Olingan natijalar bo'yicha prognoz modeli aniqlandi:

$$\hat{y}_t = 8723,389 + 478,08t \quad (6)$$

Amaliyotda bashoratlash modelini tanlab olishda hisoblab topilgan modellar mezonlar asosida solishtirilib, ulardan talabga javob beradigani tanlab olinadi. Bunda quyidagi mezonlardan foydalaniladi:

o'rtacha absolyut og'ishma

$$|A| = (y_t - \hat{y}_t) \quad (7)$$

o'rtacha kvadratik og'ishma:

$$\delta = \sqrt{\sum_{i=1}^n (y_t - \hat{y}_t)^2} \quad (8)$$

o'zgaruvchanlik (variatsiya) koeffitsiyenti:

$$v = \frac{\delta}{\bar{y}} \cdot 100\% \quad (9)$$

R korrelyatsiya koeffitsiyenti:

$$R^2 = 1 - \frac{\sum_{i=1}^n (y_t - \hat{y}_t)^2}{\sum_{i=1}^n (y_t - \bar{y})^2} \quad (10)$$

bu yerda:  $y_t, \hat{y}_t, \bar{y}_t$  - vaqt qatorining boshlang'ich, nazariy va arifmetik o'rtacha darajalari;  $n$  - parametrlar (qatorlar) soni [9].

2-jadval

Bashoratlash modelini mezonlar asosida tahlili

Hisobot davri, yil	$\hat{y}_t = 8723,389 + 478,08t$	
	$y_t - \hat{y}_t$	$(y_t - \hat{y}_t)^2$
2012	-660,5	436282,7
2013	91,6	8387,8
2014	831,9	692016,0
2015	961,1	923688,2
2016	-681,6	464581,3
2017	-649,9	422412,9
2018	-89,1	7933,3
2019	-140,2	19663,6
2020	-469,5	220452,8
2021	478,5	228991,9
2022	1176,1	1383126,5
2023	-713,9	509677,5
2024	-133,7	17877,8
Jami:	0,6	5335092,4

Jadvalda hisoblangan ma'lumotlar boyicha solishtirish mezonlari hisoblab chiqiladi (2- jadval).

### 3. Natija va muhokamalar

Yuqorida keltirilgan formulalar va 2-jadval yordamida quyidagi mezonlar hisoblanadi:  $|A|, \sigma, v$  va  $R^2$ .

3-jadval

Ishlab chiqildan modellarni mezonlarni hisoblash jadvali

Ishlab chiqilgan model	Mezonlar			
	$ A $	$\sigma$	$v$	$R^2$
$\hat{y}_t = 8723,389 + 478,08t$	0,6	2309,78	33,8	0,95



Tahlil shuni ko'rsatadiki, parabolik funksiya asosida olingan model barcha mezonlar bo'yicha qo'yilgan talablarga javob beradi, shu sababli prognoz qilish uchun ushbu modelni qabul qilamiz [10].

Kvadratik parabola asosida ishlab chiqilgan modelga ko'ra avtomobil transportida tashilgan konteynerlar soni 2025 – 2027 yillar uchun prognoz qiymatlari quyidagi ko'rishda bo'ladi:

$$\hat{y}_t = 8723,389 + 478,08t$$

2025 – yil uchun (t=7)

$$\hat{y}_t = 8723,389 + 478,08 \cdot 7 = 12569,95 \text{ m.t.}$$

2026 – yil uchun (t=8)

$$\hat{y}_t = 8723,389 + 478,08 \cdot 8 = 12808,03 \text{ m.t.}$$

2027 – yil uchun (t=9)

$$\hat{y}_t = 8723,389 + 478,08 \cdot 9 = 13026,11 \text{ m.t.}$$

#### 4. Xulosa

Xalqaro yo'nalishlarda avtomobil transportida tashilgan yuk hajmlarini o'zgarishini ifodalash maqsadida ishlab chiqilgan model va prognoz natijalariga ko'ra tashilayotgan yuk hajmi yildan yilga o'sib borishi kuzatilmoqda. Yuklarni xalqaro tashishda avtomobil transportining iqtisodiy samaradorligini oshirish nuqtai nazaridan ham xalqaro tashishda turli transportlar harakatini muvofiqlashtirish masalalariga alohida e'tibor qaratish zarur.

#### Foydalangan adabiyotlar / References

[1] Marupov M., Yusufkhonov Z. – CHOICE OF THE OPTIMUM FORECASTING MODEL IN DIFFERENT VALUE OF INITIAL INFORMATION. UNIVERSUM. pp. 23-26.

[2] Ceder A. – Public-Transport Automated Timetables using Even Headway and Even Passenger Load Concepts Transportation, 32nd Australasian Transport Research Forum. 2009. pp.1-17.

[3] Жураев М. Н., Ахмедов Д. Т., Мустанов О. Г., Юсуфхонов З. Ю. – Оценка влияния состояния дорожной инфраструктуры на характер координационной модели. Universum: технические науки. 2022. стр. 2-3, 19-24.

[4] Kosimov M. – PECULIARITIES OF THE ORGANIZATION OF LOGISTICS SERVICES IN INTERNATIONAL FREIGHT. In ECONOMIC ASPECTS OF INDUSTRIAL DEVELOPMENT IN THE TRANSITION TO A DIGITAL ECONOMY. 2020. pp. 44-49.

[5] Giyasidinov A. Sh., Maxmudov J., Samatov G. A., Sarvirova N. S. – E-CMR-an impulse to innovative development of the transport industry. International Engineering Journal For Research & Development. 2020. pp 5-6.

[6] Саматов Г. А., Сарвирова Н. С. – Эффективность создания экономической системы цифровых транспортных коридоров. Транспорт в интеграционных процессах мировой экономики. 2020. стр. 77-78.

[7] Атаджанова З. С., Мурадов А. С. – Пути развития логистической инфраструктуры железнодорожного транспорта. Логистика-евразийский мост. 2019. pp. 22-26.

[8] Murodov A., Atajanova Z., Yusufkhonov Z. – DETERMINATION OF THE MAIN CRITERIA WHEN SELECTING CARGO TRANSPORTATION. UNIVERSUM. pp 27-29.

[9] Jyraev M., Yusufkhanov Z., Akhmedov D. – Modeling the system of vehicle and driver activity. Universum: технические науки, 2022 (1-3 (94)), pp. 71-73.

[10] Urokovich K. A., Axmedovich M. I., Dostmurodovich S. O. XALQARO MARSHRUTLARDA YUK OQIMLARINI O'Z MUDDATIDA YETKAZIB BERISHNI REJALASHTIRISH. Eurasian Journal of Academic Research. 2024. 4(2-2), 73-78.

#### Mualliflar to'g'risida ma'lumot/ Information about the authors

Xudaynazarov  
Furqat  
Baxtiyorovich /  
Khudaynazarov  
Furkat  
Bakhtiyorovich

Strategik tahlil va istiqbolni belgilash  
oliy maktabi, mustaqil tadqiqotchisi.  
E-mail: [saidvishka1@gmail.com](mailto:saidvishka1@gmail.com)  
Tel.: +998931117727  
<https://orcid.org/0009-0009-2998-3964>



**D. Mahmudova**

*Impact of increasing labor productivity in the company contributing factors.....139*

**S. Absattarov, N. Tursunov**

*Numerical Simulation of the spatial distribution of temperature fields in spring elements of freight wagons of railway transport...141*

**U. Khusenov, Sh. Suyunbaev**

*Methodology for assessing the impact of the main comparative resistance to movement of various wagons on the weight of the freight train.....146*

**F. Khudaynazarov**

*Development of a forecasting model of the change in the volume of international cargo transportation in automobile transport.....151*

**O. Kasimov, R. Isroilov, Z. Isomov**

*Study of the causes of corrosion in the insulating materials of traction motors.....154*

**A. Artykbaev, M. Toshmatova**

*Mathematical model of railway plan.....158*