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RESEARCH, INNOVATION, RESULTS



**TOSHKENT DAVLAT
TRANSPORT UNIVERSITETI**

Tashkent state
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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.

Application of geoinformation systems (GIS) in the analysis of transport flows

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Abstract: This article analyzes the role, importance and areas of application of geoengineering systems (GIS) in the analysis and management of traffic flows. With the help of GIS technologies, methods for modeling road networks, determining traffic density, predicting traffic jams and improving the efficiency of traffic logistics are considered. This paper carried out spatial analysis of transport flows based on applications such as QGIS and ArcGIS.

Keywords: geoinformation system, transport flow, spatial analysis, road network, transport logistics, GIS technologies

Transport oqimlarini tahlil qilishda geoaxborot tizimlarining (GAT) qo'llanilishi

Abduvaliyev A.¹ ^a

¹Qarshi davlat texnika universiteti, Qarshi, O'zbekiston

Annotatsiya: Mazkur maqolada transport oqimlarini tahlil qilish va boshqarishda geoaxborot tizimlarining (GAT) o'rni, ahamiyati hamda qo'llanilish yo'nalishlari tahlil qilinadi. GAT texnologiyalari yordamida yo'l tarmoqlarini modellashtirish, transport harakati zichligini aniqlash, tirbandliklarni bashorat qilish va transport logistikasi samaradorligini oshirish usullari ko'rib chiqiladi. Ushbu maqolada QGIS va ArcGIS kabi dasturlar asosida transport oqimlarining fazoviy tahlili amalga oshirilgan.

Kalit so'zlar: geoaxborot tizimi, transport oqimi, fazoviy tahlil, yo'l tarmog'i, transport logistikasi, GAT texnologiyalari

1. Kirish

Hozirgi kunda transport tizimi mamlakat infratuzilmasining eng muhim tarkibiy qismi hisoblanadi. Shahar va mintaqalarda transport oqimlarini samarali boshqarish iqtisodiy rivojlanish, ekologik barqarorlik va aholining hayot sifatini yaxshilashda muhim o'rin tutadi.

An'anaviy usullar transport harakatini o'lchash va tahlil qilishda ko'p vaqt talab etadi hamda aniqlik darajasi past bo'ladi. Shu sababli zamonaviy texnologiyalar, xususan Geoaxborot tizimlari (GAT) asosida transport oqimlarini raqamli shaklda modellashtirish va tahlil qilish usullari keng joriy etilmoqda.

GAT texnologiyalari transport ma'lumotlarini fazoviy kontekstdagi tahlil qilish, vizualizatsiya qilish va qaror qabul qilish jarayonini avtomatlashtirish imkonini beradi. An'anaviy usullardan farqli o'laroq, GAT bazasida transport oqimlarini modellashtirish va tahlil qilish — nafaqat vaqt va resurslarni tejaydi, balki bor ma'lumotlarni vizual tarzda ko'rsatish, turli ma'lumot manbalarini birlashtirish va kompleks qarorlar qabul qilish imkoniyatini yaratadi. Shu jihati bilan bu usul zamonaviy transport infrastrukturasini va harakatini boshqarishda muhim yangilik sifatida qaralmoqda. Shuningdek, GAT integratsiyasi orqali transport tizimida ekologik, ijtimoiy va iqtisodiy jihatlarni ham e'tiborga olinadi — transport harakati va yo'l infratuzilmasi bilan bog'liq havoning ifloslanishi, umrga

ta'siri, yo'l xavfsizligi, faol hududlarning yaqinligi kabi omillar geografik ma'lumotlar bilan bog'lanib tahlil qilinadi.

2. Tadqiqot metodologiyasi

Ushbu maqolada asosiy metodologik yondashuvi transport oqimlarini GAT texnologiyalari asosida modellashtirish va tahlil qilishga qaratilgan. Transport harakatining fazoviy va vaqtinchalik o'zgarishlarini aniqlash hamda tirbandlik darajasini baholash orqali samarali boshqaruv qarorlarini ishlab chiqishdir.

Tahlil natijalari:

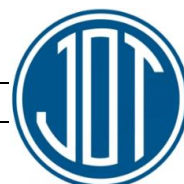
Transport oqimlarini tahlil qilish uchun GAT texnologiyalari yordamida quyidagi ma'lumotlar to'plandi:

Ma'lumotlarni yig'ish: Yo'l tarmoqlari, svetoforlar, chorrahalar, jamoat transporti bekatlari haqidagi ma'lumotlar OpenStreetMap va GPS manbalaridan olindi transport vositalarining harakat tezligi va yo'nalishlari haqidagi ma'lumotlar real vaqt rejimida yig'ildi.

GAT platformalarida tahlil: QGIS dasturida shahar yo'l tarmoqlari raqamlashtirildi. "Heatmap" (issiqlik xaritasi) vositasi yordamida transport oqimining zichlik darajalari tasvirlandi. "Network Analyst" moduli orqali eng samarali marshrutlar aniqlanib, tirband joylar belgilandi.

Model yaratish: Transport oqimlari uchun statik va dinamik modellar ishlab chiqildi. Dinamik model orqali kun davomida transport harakatidagi o'zgarishlar kuzatildi.

^a <https://orcid.org/0009-0003-9795-4854>



Transport oqimining intensivligi quyidagi formula bilan aniqlanadi:

$$Q = k \cdot v$$

Bu yerda:

Q — transport oqimi (avtomobil/soat),

k — transport zichligi (avtomobil/km),

v — oʻrtacha tezlik (km/soat).

Agar vaqt boʻyicha oʻzgarish hisobga olinsa:

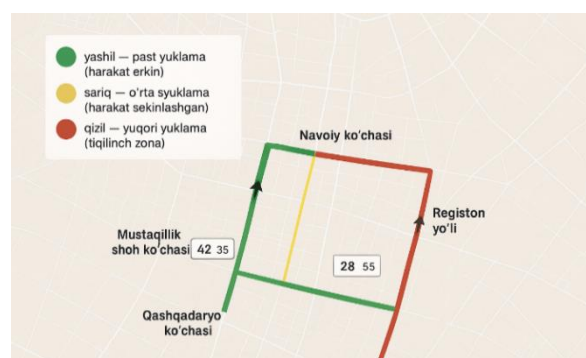
$$Q(t) = k(t) \cdot v(t)$$

Bu model yordamida har bir yoʻl segmentida vaqtga nisbatan oqim oʻzgarishi tahlil qilinadi.

Qarshi shahrining markaziy yoʻllarida transport oqimi kuzatildi. Quyidagi jadvalda GAT tahlili asosida olingan natijalar keltirilgan:

1-jadval

GAT tahlili asosida olingan natijalar				
Yoʻl nomi	Oʻrtacha tezlik (km/soat)	Zichlik (avto/km)	Oqim (avto/soat)	Tiqilinch darajasi (GAT tahlili)
Mustaqillik shoh koʻchasi	42	35	1470	Oʻrta
Navoiy koʻchasi	28	55	1540	Yuqori
Qashqadaryo koʻchasi	36	30	1080	Past
Registon yoʻli	25	60	1500	Yuqori



1-rasm. GAT asosida Qarshi shaharida transport oqimlarini tahlil qilish xaritasi (mualliflar tomonidan tuzilgan)

Transport tizimida kechikish vaqti T_d quyidagicha ifodalanadi:

$$T_d = \frac{L}{v} - \frac{L}{v_f}$$

Bu yerda:

L — yoʻl uzunligi (km),

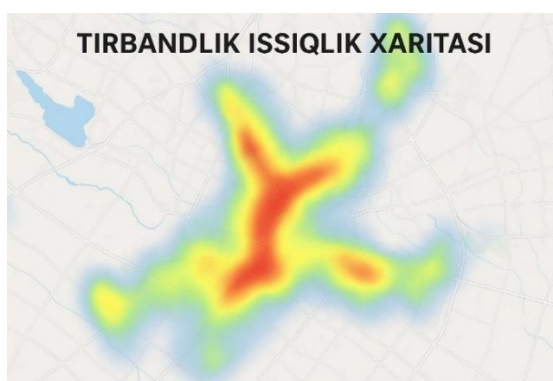
v — haqiqiy tezlik (km/soat),

v_f — erkin harakat tezligi (km/soat).

3. Natijalar

Tahlil natijalari shuni koʻrsatdiki: Transport oqimining eng yuqori zichligi 07:30–09:00 va 17:30–19:00 oraligʻida kuzatildi. Shahar markazidagi asosiy chorrahalarda harakat tezligi 20–25 km/soatgacha pasaygan. QGIS orqali yaratilgan “tirbandlik issiqlik xaritasi” yordamida transport oqimining kritik nuqtalari aniqlandi. “Network Analyst” moduli orqali alternativ marshrutlarni tanlash orqali harakat vaqti 12–15% ga qisqargani kuzatildi.

Shuningdek, GAT asosida olingan maʼlumotlar shahar transport infratuzilmasini rejalashtirishda aniqroq qarorlar qabul qilish imkonini berdi.



2-rasm. QGIS dasturi orqali tirbandlik issiqlik xaritasi ishlab chiqildi

Oqim zichligi — yoʻlning maʼlum uzunligida joylashgan avtomobillar sonini bildiradi:

$$k = \frac{N}{L}$$

bu yerda:

k — yoʻl boʻlagidagi transport zichligi (avtomobil/km),

N — avtomobillar soni,

L — yoʻl uzunligi (km).

Zichlik ortishi bilan transport harakati sekinlashadi, tirbandlik xavfi oshadi.

Oʻrtacha tezlik — avtomobillarning yoʻl boʻylab harakatlanish tezligini bildiradi:

$$v = \frac{L}{t}$$

bu yerda:

v — oʻrtacha tezlik (km/soat),

L — yoʻl uzunligi (km),

t — oʻrtacha harakat vaqti (soat).

Tezlik transport zichligiga teskari proporsionaldir: zichlik oshgani sayin oʻrtacha tezlik kamayadi.

Oqim intensivligi — yoʻl kesimidan bir vaqt birligida oʻtuvchi avtomobillar sonini bildiradi:

$$q = k \cdot v$$

bu yerda:

q — transport oqimining intensivligi (avtomobil/soat),

k — zichlik (avtomobil/km),
 v — oʻrtacha tezlik (km/soat).

Bu tenglama transport tizimlaridagi asosiy munosabat hisoblanadi. U orqali tirbandlik chegarasini va maksimal oqimni aniqlash mumkin.

Olingan natijalar GAT texnologiyalarining transport boshqaruvi tizimida yuqori samaradorlikka ega ekanini koʻrsatadi. Anʼanaviy usullarga nisbatan GAT asosidagi tahlillar:

maʼlumotlarni fazoviy kontekstda koʻrsatadi;

real vaqtli monitoring imkonini beradi;

transport rejalashtirish va marshrut optimallashtirish jarayonlarini avtomatlashtiradi.

Bu yondashuv nafaqat shahar infratuzilmasini samarali boshqarish, balki ekologik va iqtisodiy foyda keltiruvchi tizimlar yaratishda ham muhim ahamiyat kasb etadi.

4. Xulosa

Yuqoridagi tahlillar natijasida aniqlanishicha, Geoaxborot tizimlari (GAT) transport oqimlarini tahlil qilishda muhim amaliy ahamiyatga ega boʻlib, u transport tizimini raqamlashtirish, boshqaruvni avtomatlashtirish hamda tirbandliklarni kamaytirish jarayonlarida samarali vosita sifatida xizmat qiladi. GAT texnologiyalari orqali transport harakatining asosiy parametrlarini — zichlik, tezlik va oqim intensivligini — fazoviy maʼlumotlar bilan birgalikda tahlil qilish imkoniyati yaratiladi. Bu esa shahar infratuzilmasining holatini aniq baholash, transport tarmogʻining yuklanish darajasini aniqlash va muammoli nuqtalarni aniqlash imkonini beradi. Transport maʼlumotlarini raqamli shaklda yigʻish, saqlash va vizual tahlil qilish imkoniyati. Tirbandlik issiqlik xaritalari

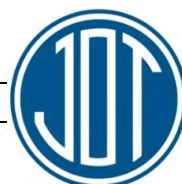
(heatmap) yordamida kritik nuqtalarni tezda aniqlash. Transport harakatini real vaqt rejimida monitoring qilish va bashorat modellarini ishlab chiqish imkoniyati.

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