**Prospects for Effective Organization of the   
Tashkent-Samarkand Toll Road Network**

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**Abstract.** This article contains information on the creation, quality assurance and improvement of control over the operation of the Tashkent-Samarkand Road network on a fee basis, the study, planning, modeling and analysis of the state of this area, the legislative framework for this task. On the basis of modern intellectual technologies, the analysis of the work carried out on the application of information and communication technologies in the optimal and safe Organization of traffic flows and road traffic, improving the transport and operational quality of highways, the quality of transport services provided to the population, the high level and effective organization of the activities of the road and It has been considered about the types of activities that the population needs to develop in order to maintain the required level of mobility. Methods for determining the level of service quality (LOS)of the road are described, modeling the state of the road using computer programs adapted for various exactly this, and analyzing it through simulation qiish. The results of foreign experiments in this regard are presented. At the end of the article, thoughts were made about the work done to this day, the scope and sources of expenses, the deadlines for the completion of the work, responsible organizations, enterprises and plans in the future.

**Keywords:** Road safety, intelligent transport systems, the legal basis for the control of the transport sector, an integrated approach, toll roads, economic efficiency, the degree of mobilization of the population, foreign experience, modern intelligent technologies, optimization of the transport sector, mobility of the population, new opportunities for road users

**INTRODUCTION**

The Independent Republic of Uzbekistan stands at one of the leading places in production and large-scale construction work and daily food production and production within the countries of Central Asia, and all together use various transport services. Currently, the role of managing vehicles through information technology and intellectual transport systems in order to achieve high results in terms of cargo and passenger productivity carried with them is unparalleled. One of the main tasks of the transport system of Uzbekistan is to increase the quality of transport services provided to the national economy and population, by organizing the activities of the road and transport complex at a high level and efficiently.[1, 2, 3, 4, 5]

To maintain the required level of mobility of the population, it will be necessary to develop two complementary activities: the construction of new roads and the effective organization of the organizational management of the transport system with the help of information and telecommunication and telematics technologies. In modern practice, the limited funds allocated to improve the transport and operational quality of highways are used to repair problem road sections instead of preventing their occurrence.

The use of information and communication technologies in the optimal and safe Organization of traffic flows and road traffic on the basis of modern intellectual technologies is of great benefit to the economy. In the conditions of Uzbekistan, a toll road or toll tunnel, a bridge or a road conductor have not yet been introduced. Such artificial structures should be designed according to a thorough plan, built and put into practice, taking into account both economic aspects. [6, 7, 8, 9, 10]

A toll road is a highway where drivers are charged a certain fee. This fee is introduced to cover the cost of building and maintaining the road. Often this system is introduced on high-speed roads, bridges and tunnels.

Paid roads have existed in one form or another since ancient times. The ransom was levied on travelers who rode both by wagon and on horseback and on foot. Paid highways, on the other hand, evolved with the advent of automobiles, and today tolls apply only to vehicles. While the fare amounts vary depending on the class of the vehicle, its weight, or the number of wheel axles, tariffs for larger and heavier vehicles are usually higher than for light cars.

Many modern European roads were originally built toll roads to cover construction and operating costs, as well as to provide additional revenue to the budget at the expense of users who are not residents of the region. As early as the 14th century, some of the most used roads in England were repaired with funds received from users. In general, high-speed highways, bridges and tunnels are built on the basis of public private partnerships, and this system is used to pay for the long-term loan received for the construction and operation of these facilities.[11, 12, 13]

**RESEARCH METHODS**

The benefits of modern toll roads:

❖ You get to your destination faster because: one of the most popular advantages of paid roads is that they significantly save travel time compared to other destinations. The permissible speed, on the other hand, is larger than an alternative free route, that is, it can move from a speed of at least 110 km/h to an even unlimited speed (Germany). These roads do not generate traffic due to the scarcity of cars and the high speed, and at the expense of the good lighting of the entire road, you are less tired and, accordingly, less stop to rest, so the travel time is noticeably reduced.

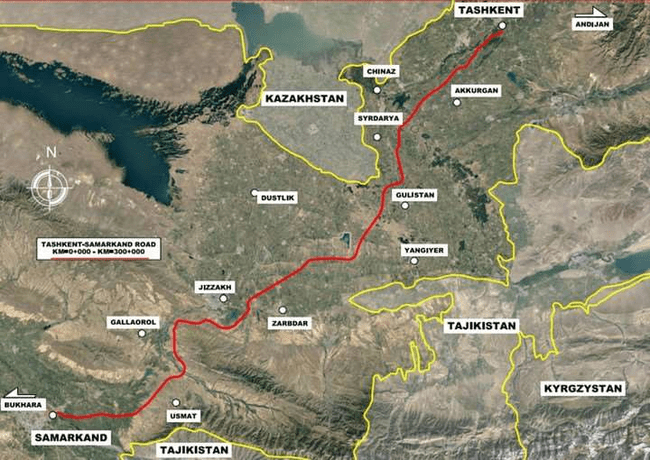
❖ Economical economy you pay the fare, but you avoid the wear of fuel consumption and the depreciation of the car, because: because of the short length of the route, you drive less and move on a road with a good finish. Due to the high coefficient of engagement in this, the mechanisms of your car will not break.

❖ Paid Road a separator region has been established with the aim of obtaining a more secure confrontation of participants of the opposite movement. The entire road is well lit, thanks to which the driver gets less tired of his eyes and focuses attention on safety. The quality of the road cover, on the other hand, is high, and there are almost no different irregularities and depressions on the road, and storage work is carried out at all times. The use of such a road in any conditions and in any season is not a risk. [14, 15, 16, 17, 18]

Modern toll roads are now a highly developed sector in European countries. There are also plans to build toll roads in Uzbekistan. In the coming years, we can also see modern paid roads on the territory of Uzbekistan. For example, according to a message from the Ministry of Transport, The Tashkent-Samarkand toll road construction project is expected to be accelerated (Figure 1).

The technical economic basis of this paid road construction project is being developed by the Turkish company Proyapı Mühendislik ve Müşavirlik, hired by the European Bank for Reconstruction and development. For this, grant funds in the amount of $1.5 million are directed. Construction was cited to begin on PQ-330 in June 2025, and the Ministry of Transport and the highway committee were designated in charge. According to preliminary estimates, the total capital cost of the project is approximately 1.5 billion. Exceeds US dollars. The total construction period for a 300-kilometer road can be 5-8 years according to the construction sequence [19, 20, 21, 22].

According to preliminary estimates by the European bank for reconstruction and development, the estimated cost of road use was set at us $ 5 and US $ 7 for light cars and light trucks, and US $ 15-20 for trucks and buses. According to international experience, when a toll road is built, a free alternative road is usually maintained for residents.



**FIGURE 1.** Tashkent-Samarkand toll road project

To understand the infrastructure and components of the paid road, we divide it into the following sections:

**Road surface:**

- Asphalt and concrete: asphalt roads have more flexibility, but often require maintenance. Concrete roads, on the other hand, have a longer service life, but higher construction costs.

- Structural layers of the road: the road consists of a base, a base layer, a solid layer and a top layer. Each is important to ensure road endurance.

**Payment systems:**

Electronic payment systems: RFID (Radio Frequency Identification): automatic payment via RFID chips embedded in vehicles.

ANPR (Automatic number Plate Recognition): reading vehicle license plates and automatic payment.

Manual payment points.

Cash receiving stations: payment by drivers with cash or cards.

Prepaid and postpaid systems: prepaid or later payment options.

**Road signs and road lines:**

- Signs: various signs for traffic control: speed limits, danger sign, road directions.

- Lines: white and yellow lines, dividing lines, to indicate road directions and ensure safe passage.

**Lighting systems:**

- Traffic lights: lighting devices to improve night visibility.

- Emergency lighting systems: additional lighting for ambulance and other services.

**Video surveillance systems:**

- Control of traffic rules: speed monitoring, ignoring the red light, detecting other violations.

- Ensuring security: identification and Prevention of criminal activity.

**Means for emergency services:**

- Phone bottles: phones to call emergency assistance along the way.

- Help points: for road patrol services or road maintenance.

**Road maintenance facilities:**

- Cleaning and repair techniques: techniques and equipment for cleaning the road, cleaning from snow, patching cracks.

– Self-renewable road materials: automatic recovery of small cracks with the help of technological advances.

**Information systems:**

- Electronic tables: displays that provide information about traffic jams, road condition and weather conditions in Real time.

- Mobile applications: programs to inform passengers about the road and make payments.

**Environmental Protection facilities:**

- Noise barriers: to protect settlements located along the road from noise.

- Drainage systems: water drainage systems, road flooding prevention and irrigation

**Parking and rest areas:**

- Rest areas: parking and rest facilities for passengers located along the road.

- Fuel stations:fuel vehicles.

- Restaurants and cafes: to allow passengers to eat and relax.

Each of these components together ensures the efficiency, safety and ease of use of paid roads. [23, 24, 25, 26]

The level of service quality (LOS) of the road is one of the most important factors. Level of service (LOS) is a quality indicator used to determine the quality of service to vehicles. LOS is used to analyze roads and intersections by categorizing traffic flow and setting traffic quality levels based on productivity measures such as vehicle speed, density, congestion and the like. It is possible to determine the level of service for vehicles, pedestrians, cyclists and, in general, for all objects in the transport infrastructure. The level of service can vary between the length of the road and the day, month, year for each section of Service. There was a total of 6 grades, marked with A, b, c, D, E, F.[27, 28, 29, 30]

**TABLE 1.** The line has a service level of

|  |  |  |  |
| --- | --- | --- | --- |
| Service level | Load factor | Moving speed coefficient | Motion saturation coefficient |
| A | < 0,2 | > 0,9 | < 0,1 |
| B | 0,2 – 0,45 | 0,7 – 0,9 | 0,1 – 0,3 |
| C | 0,45 – 0,7 | 0,55 – 0,7 | 0,3 – 0,7 |
| D | 0,7 – 0,9 | 0,4 – 0,55 | 0,7 – 1 |
| E | E 0,9 – 1,0 | <0,4 | 1 |
| F | > 1,0 | 0,3 | 1 |

**RESULTS AND DISCUSSIONS**

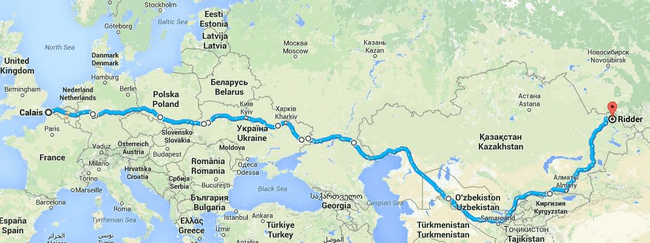
There are several ways to determine the level of service of the road:

1. By counting: - by Delay Time values; - in terms of movement speed values; - by action density values; - on the values of the intensity of movement.

2. The use of statistics (on relevant archival data and materials, completed projects and research).

3. Road traffic modeling methods. Analysis of the state of the path by modeling and simulation qiish using computer programs adapted for various exactly this. From these we use the method of road traffic modeling.

Current state indicators of highways in the Republic of Uzbekistan. The M39 motorway is part of the E40 motorway. The E40 is the longest European route of 8,000 km, connecting Kale, France via Belgium, Germany, Poland, Ukraine, Russia, Kazakhstan, Uzbekistan, Turkmenistan and Kyrgyzstan near the Chinese border with Ridder, Kazakhstan. Traffic on this road does not stop around the clock (Figure 2).



**FIGURE 2.** E40 motorway route The route "Tashkent-Samarkand"can be divided into 4. These are:   
1. Tashkent-Chinoz 2. Chinoz-Syrdarya 3. Syrdarya-Jizzakh 4. Jizzakh-Samarkand

**TABLE 2.** Tashkent-Chinoz

|  |  |  |
| --- | --- | --- |
| **Index name** | **Indicator data** | **Further information** |
| Length of track section | 68 km |  |
| Type of road cover and its condition | Asphalt concrete coating | Highway of international importance, the condition of the road along the entire length of the plot is good |
| Track year-to-month operation | Year round | The area is flat |
| Total number of lanes | 4 | Separated by metal structure |

**TABLE 3.** Chinoz-Syrdarya

|  |  |  |
| --- | --- | --- |
| **Index name** | **Indicator data** | **Further information** |
| Length of track section | 2 km | It was crossed by a bridge over the Syrdarya River |
| Type of road cover and its condition | Asphalt concrete coating | Highway of international importance, the condition of the road along the entire length of the plot is good |
| Track year-to-month operation | Year round | The area is flat |
| Total number of lanes | 4 | Separated by reinforced concrete structure |

**TABLE 4.** Syrdarya-Jizzakh

|  |  |  |
| --- | --- | --- |
| **Index name** | **Indicator data** | **Further information** |
| Length of track section | 85 km | It was crossed by a bridge over the Syrdarya River |
| Type of road cover and its condition | Asphalt concrete coating | Highway of international importance, the condition of the road along the entire length of the plot is good |
| Track year-to-month operation | Year round | The ground is flat |
| Total number of lanes | 4 | Separator reinforced concrete Bruce mounted |

**TABLE 5.** Jizzakh-Samarkand

|  |  |  |
| --- | --- | --- |
| **Index name** | **Indicator data** | **Further information** |
| Length of track section | 140 km | M-39 intersects A376 at km 40, M42 at km 67, 4r48 at km 135, M37 at km 140 |
| Type of road cover and its condition | Asphalt concrete coating | Highway of international importance, the condition of the road along the entire length of the plot is good |
| Track year-to-month operation | Year round | The territory is flat, but the range of 40-67 km corresponds to a mountainous area |
| Total number of lanes | 4 | Separated by reinforced concrete structure |

The road is limited to a total traffic speed of 90-100 km/h built from 4 lanes of asphalt concrete pavement throughout its length. The number of maintenance stations is 5, the number of short stops is 9, the number of gas and fuel stations per car is 51 (Figure 3).



**FIGURE 3.** Existing highway

**COMPOSITION OF COMPUTATIONAL EXPLANATORY NOTES**

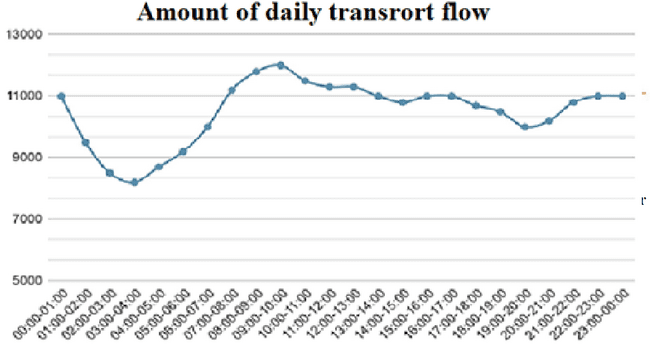
Determination of the amount of traffic flow of the road.

The amount of traffic flow (intensity) is the number of vehicles passing through the cross – section of a highway per unit of time (one hour, one day, one week, or one year). Movement intensity can be measured in two ways:

1. An automated method involves the use of portable or permanently installed equipment and allows automatic recording, calculation and storage of information about passing vehicles.

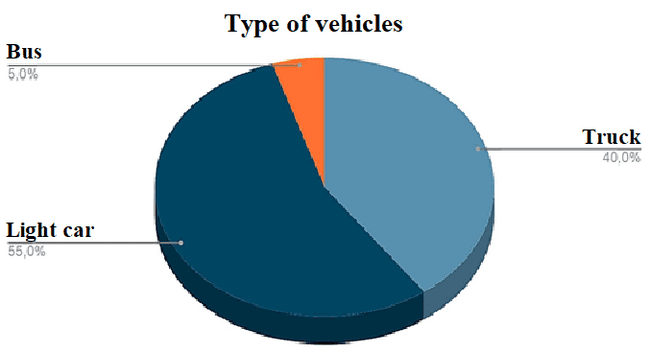
2. The visual method involves visual observation and recording of the number of vehicles passing through this highway, either manually or on electronic carriers.

An average of about 500,000 vehicles of different sizes pass the M39 motorway overnight. On the resulting daily results, a graph of the time dependence of the transport flow is built.



**FIGURE 4.** The amount of daily flow of the” Tashkent – Samarkand " road

By type of vehicles, 55% are on a light car, 5% on a bus, and 40% on trucks.



**FIGURE 5.** The composition of the daily flow amount of the”Tashkent – Samarkand" road

The calculation of the density in each direction of the path using the daily data obtained, we find the average density calculation in one direction:

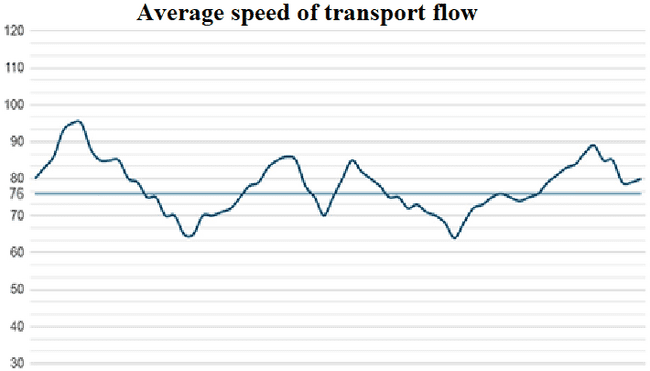
Flow

(1) we include half of the 500,000 for being one direction in the Formula,

Then we find the average speed:

Pace

(2) by adding the speed of all cars passed in the formula, we divide by the number,



**FIGURE 6.** Average flow rate

From the information found we find the density:

Density

(3) in the formula, we divide the flow by the mean velocity:

We can see through the formulas that the average density of flow in this path was 137.

Development of recommendations for the entry and exit points of the road. Description of the geometric parameters of the crossing points. The design scheme of the passage depends on many factors that determine the number of lines, width and length of the passage, including most factors.

To determine the geometric parameters of the transition point field, it is necessary to consider its structure and possible configurations. Taking into account the rules of the Ministry of Transport of the Russian Federation “methodological recommendations for the construction and placement of toll collection points”, which are currently in force in the Russian Federation, as we do not yet have a legal document on the design.

In accordance with methodological recommendations, the EEP (entry-exit point) transition system, organized at the entrance or exit of a toll road, includes the following main elements (Figure 4):

– traffic lanes for entry and exit;

- transit lane lanes for designated vehicles;

- transit road tapes for large vehicles;

- islets for the placement of fare collection booths, separation of road lanes and vehicle traffic control;

- EEP cabins with a cashier-supervisor workplace;

- lifting barriers connected to cash registers (schlagbaums;

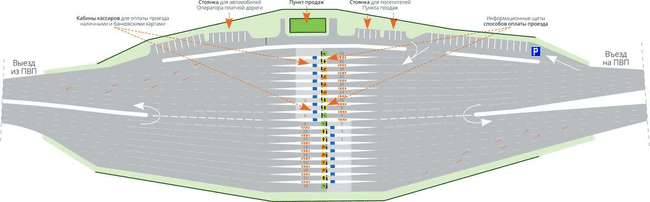
- traffic lights, indicator signs and information display and windows;

- protective roof (umbrella);

- complex connecting the complex of islets and cabins with the administrative-municipal building of the EEP;

- sensors and measuring instruments for data collection when passing vehicles;

- equipment for issuing tickets and coupons.



**FIGURE 7.** An example of a EEP field representation

There is a possible minimum of field feedback: the length of the working zone of the EEP field is at least 312 m, and the width is determined by the number of drive bands (the width of one band is 3.75 m) and the bandwidth required by the EEP and the throughput of large vehicles (at least 6 m). At the same time, the length of the input and output fields should be at least 150 m, as a result, all fields of EEP will have the same configuration and dimensions, and often differ only in the number of windows of the transition point (Figures 5, 6).

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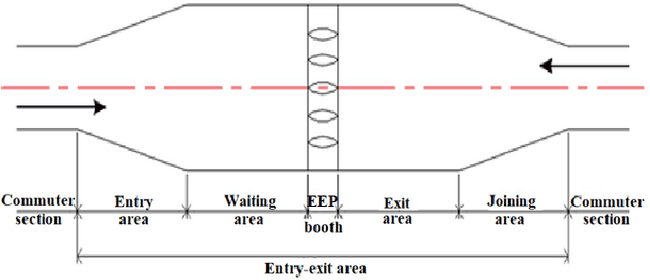
**FIGURE 8.** Realistic view of the EEP field

The choice of places of placement of the payment system and the EEP cabin is carried out at the stage of development of the “technical economic basis” of the project, taking into account the estimated intensity and structure of the traffic flow, the number and location of transport exchanges, the intensity of the transit flow and the degree of use of a paid road (or road object). The main criterion for choosing a payment system is to maximize the profit from the use of a paid Highway.



**FIGURE 9.** EEP waiting area

To analyze the operation of the crossing point, it can be shown as an area divided into zones where the vehicle passes from the entrance to the crossing point until it enters the carriageway of the highway. These regions can be divided into 4: input, wait, output and join regions. In the entry area, the vehicle re-lined up in a certain EEP cab, waiting for the waiting hudui to pay, changing its speed in the exit area and entering the main traffic flow in the junction area. The number of drive bands relative to the main track in the entrance and junction area varies according to the EEP indicators.

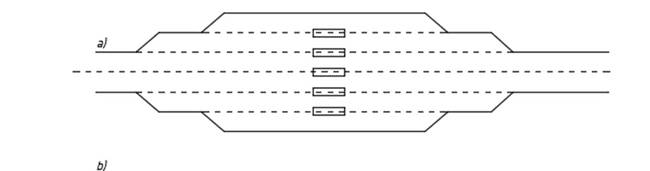


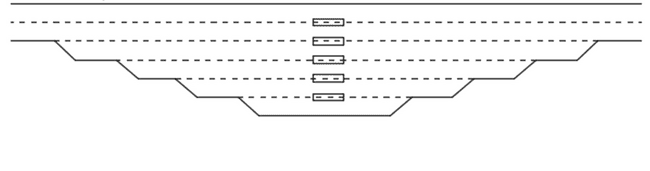
**FIGURE 10.** Main areas of the EEP area

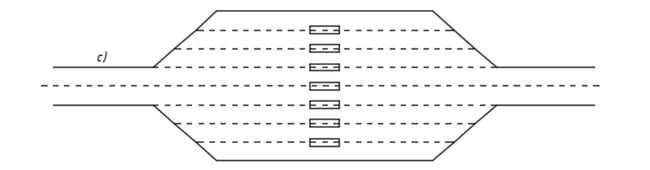
The entry exit point area starts at the entrance area and waiting area and ends after the exit area and the Join area after the service area.

The speed of driving at the entrance decreases, since drivers are re-lined up on the drive band, depending on the method of payment of their choice, tariff mode or queue length.

The length of the waiting area should be sufficient to accommodate the calculated flow. During the peak of the annual peak flow, vehicles must ensure that the queue length does not reach the Commute section. Vehicles increase speed in the exit area after the EEP cab and arrive at the junction area. In the area of the junction, however, the number of drive bands is reduced accordingly, with the main carriageway oriented. Existing accession area schemes used in different countries can be analyzed and broken down into the main three schemes.







**FIGURE 11.** EEP accession area formation schemes A is a join from two sides, b is a join from one side,   
c is a join at one point

Schemes are classified by the method of combining and separating traffic flows when approaching EEP cabins:   
a – joining from two sides, b – joining from one side, C – joining at one point.



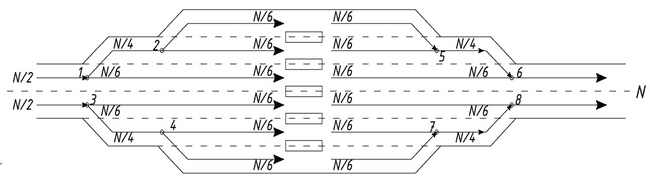
**FIGURE 12.** EEP at one point is the accession area

With the scheme for organizing EEP of type “a”, traffic flows in the input zone are re-lined in stages on both sides-the number of lines gradually increases in accordance with the required number of EEP cabins, and at the exit decreases in accordance with the main traffic lane tape. The separation and unification of transport flows according to the “B” type scheme is carried out in order to reduce them in step by step on one side at the EEP input, respectively.

The separation and unification of transport flows according to the “C” type scheme occurs at one point, at the same distance from the EEP cab.

The effect of the flow of transport in the moment on indicators. In the first of the three options mentioned above, all mergers can occur at one point, which means that all traffic flow accumulates at one conflicting point and interferes with each other in the re-alignment. One of the common ones is the second option, always combining the right (or left) line until the required amount of movement tape is achieved. This scheme is very useful to ensure high permeability, but drivers have to do the re-alignment many times. The third option is a “balanced” model in which the adjacent drive bands along the entire track join several times until the desired track width is reached. This distributes the merger evenly along the route.

The number of possible conflict situations depends on the distribution of the intensity of movement along the bands. If we have all the current entering the EEP cabins (N ta) equal ravis.



**FIGURE 13.** Distribution of traffic flow in double junction

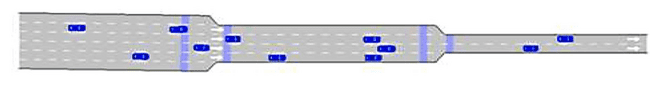
**TABLE 6**. The number of conflicting points for each joining scheme is given in the table below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Joining scheme** | **Main road tape number** | **Number of kchp cabins** | **Conflict points** | |
| **Merger** | **Divorce** |
| Type A | 2 | 6 | 4 | 4 |
| Type B | 2 | 6 | 4 | 4 |
| Type C | 2 | 6 | 3 | 3 |

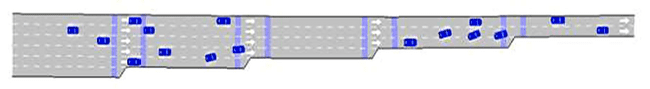
Each conflict is the time a vehicle driver loses while re – re-rounding at a checkpoint. Therefore, in order to increase the effectiveness of EEP, it is necessary to minimize the time of movement in anticipation. Because the movement of traffic flows at the junction point becomes more complicated. In increasing the efficiency of the EEP, it is enough to choose the coupling scheme in the output area.

Conflict analysis suggests that schemes with step-by-step one-way and two-way associations are less likely to have a traffic accident. In the program PTV Vissim, these schemes were developed. When evaluating circuits, the maximum speed, minimum speed, maximum acceleration, minimum acceleration, the number of vehicles that can pass the field through the exit and junction areas, the time loss indicators when passing through the EEP area are used parameters.

The model includes vehicles from sensors installed at attachment and separation points.



**Scheme 1**



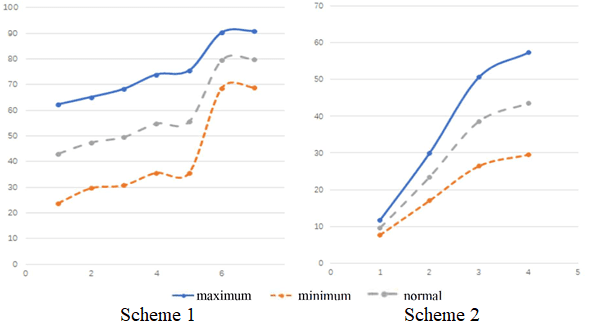
**Scheme 2**

**FIGURE 14.** Sensor mounted locations

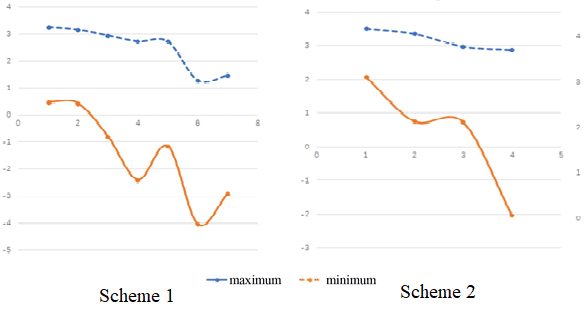
**TABLE 7.** Results obtained after sensor installation

|  |  |  |  |
| --- | --- | --- | --- |
| **Scheme** | **Waiting time, s** | **Time on the road, s** | **Number of vehicles passed** |
| 1 | 4,8 | 12,9 | 356 |
| 2 | 4,9 | 13,4 | 352 |

The first circuit has the lowest waiting and passing times, as well as the highest conductivity, but, at the expense of the speed and acceleration parameters and “blind spots”, the second action circuit will be safer.



**FIGURE 15.** Speed of movement



**FIGURE 16.** Propulsion acceleration

**CONCLUSION**

The data obtained show that the lower the speed and acceleration in the drive circuits, the safer the drive. These indicators can change at the expense of conflict (attachment and separation) points. It will be necessary to multiply these parameters depending on the degree of use of this EEP or decrease within the requirement.

Toll highways are of great importance to the economy of countries, as they are in many cases the basis of the road network, providing a large volume of rapid freight traffic on the most important routes. Such relationships are based on the principle of “user pays”, and the use of the highway is considered as a service provided by the state. The legal and economic restructuring of these processes should be carried out in stages.

Currently, the state of highways is given great attention by our President. But it is worth insisting that no matter how much money is allocated to this area, it is still considered less.

Including, it is necessary to always invest in this area by keeping the road condition in good condition, improving it using high scientific technological advances and integrating it with modern technologies. Considering the economic efficiency of the road above current and supply situations, it was considered that the amount of traffic on the Tashkent-Samarkand route was very large, it was necessary to ensure that the flow of traffic on this route was continuously moving. By simulating, we have cited the economic efficiency of the route above. We promoted LOS from F to E. Through our proposed project, the total fuel consumption of 1 hour by saving 45 seconds is 80 liters, the amount of exhaust gases entering the atmosphere is 1.6 k.

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