Justification of the Width of the Zone Allocated for Highways

Dilfuza Makhmudova1, a) and Ongdabek Rabat2, b)

1*Tashkent State Transport University, 1 Temiryulchilar St., Tashkent 100167, Uzbekistan*2*L.B. Goncharov Kazakh Automobile and Road Institute, pr. Rayymbeka, 417, Almaty, Kazakhstan*

*a) Corresponding author:* [*dilfuz240570@mail.ru*](mailto:dilfuz240570@mail.ru) *b) rabat747@mail.ru*

**Abstract.** This article examines the justification and conditions for determining the width of the land strip allocated for public roads in the Republic of Uzbekistan. It outlines the methodologies for calculating the width, requirements set forth in national regulatory documents, and how these differ from standards adopted in other countries. Additionally, the study analyzes the practical implementation of these requirements. Key factors influencing changes in the designated strip width include population growth, increased vehicle ownership, rising gross regional output, and a sharp increase in traffic intensity caused by the growing number of highway passengers. The research is based on the M39 highway ("Almaty – Bishkek – Tashkent – Shakhrisabz – Termez"), which is one of the busiest transport corridors in the republic. The current condition of the allocated strip along this route has been assessed. The study emphasizes the importance of considering road geometry, terrain characteristics, safety standards, and other parameters when determining the strip width. Furthermore, the process of cadastral registration must account for the active use of the highway and the development needs of roadside service infrastructure within the designated zone.

**Keywords:** roadroad, road zone, relief, geometric size, roadway, traffic intensity, slope gradient, roadbed, safety, embankment, embankment, traffic lanes, dividing strip

INTRODUCTION

According to the Law of the Republic of Uzbekistan "On Roads," "**Separated Zone"** refers to a land plot granted for permanent use in the manner prescribed by law for the placement of a highway, its corresponding structural elements and engineering structures, as well as buildings and structures necessary for the operation of the highway, for the creation of protective and ornamental plantations, and "**Roadline Zone"** refers to a land plot adjacent to the separated zone, within the boundaries of which special conditions for land use are established to ensure the safety of the population and the safety of traffic [1].

In the Decree of the President of the Republic of Uzbekistan dated 10.10.2023 No. PP-330 "On Measures for Further Improvement of the Road Management Sector" [2], it is specifically noted that "by the end of 2024, the phased relocation of illegally constructed buildings and structures in the designated roadside zones of public roads, streets of cities and other settlements, as well as the reconstruction of access roads to buildings and structures located as designated roadside zones, in accordance with urban planning norms, will be ensured.

METHOD

Public roads are subdivided into roads of international, state, and local significance: roads of international significance - roads included in the network of international roads in accordance with international treaties of the Republic of Uzbekistan; roads of state significance - roads providing transport links between the administrative centers of regions and districts of the Republic of Uzbekistan, cities of regional subordination, cultural and industrial centers, and connecting these centers with roads of international significance, airports, railway stations, ports and shipyards, as well as with neighboring states; roads of local significance - roads connecting administrative centers of districts with towns, villages and auls, as well as with roads of state significance [3, 4, 5].

The width of the zone allocated for highways in the countries of the world was studied and presented in the following Table 1 [6, 7, 8, 9, 10, 11].

**TABLE 1.** The width of the zone allocated for highways in the some countries

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Road category | Kazakhstan | Kyrgyzstan | Germany | Russia | Turkey | Republic of Belarus | Azerbaijan |
| I | 70 | 64 | 60 | 100 | 55-70 | 65-80 | 75 |
| II | 40 | 32 | 50 | 75 | 40-50 | 45-60 | 50 |
| III | 30 | 28 | 40 | 50 | 25-35 | 35-40 | 35 |
| IV | 26 | 26 | 30 | 35 | 20-25 | 25-30 | 30 |
| V | 24 | 24 | 20 | 25 | 15-20 | 10-20 | 20 |
| Source | Law of the Republic of Kazakhstan "On Highways" No. 245  July 17, 2001 | Law of the Kyrgyz Republic  About automobile roads  From May 22, 2023, No. 104 | Guidelines for the Installation of Highways (RAA) | SNIP No. 467 | Automobile Technical Standards (General Directorate of Automobile Roads of Turkey) | TKP 45-3.03-19-2006 (02250) | SNiP 2.05.02-85 (national adaptation) |

As of 2023, the total length of roads in the Republic of Uzbekistan amounts to 209,496 km, of which 42,869 km are designated as public roads. The procedure for allocating land for highways is regulated by the national standard SHNK 2.10.01-23, Determination of Land Area Dimensions for the Construction of Flat and Linear Structures. According to this document, when determining the width of the land strip allocated for highways, the following factors must be taken into account [12]: the road category, the number of traffic lanes, the height of elevation above the natural ground level, the depth of roadbed excavation, the presence or absence of auxiliary shoulders along the route, the slope gradient, and the location of road service infrastructure [3].

The procedure for allocating land for highways of the Republic of Uzbekistan According to the regulatory document SHNK 2.10.01-23 "Determining the dimensions of land plots for the construction of flat and linear structures" (Appendix 15), the dimensions of the width of the strip allocated for highways are given in Table 2 [3]:

**TABLE 2.** Standards for determining the required sizes of land plots (m) for determining the boundaries of highways passing through embankments

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Embankment height | With the location of the embankment slopes | | | | | | | | | |
| on flat terrain with a transverse slope from 0 to 9 percent | | | | | on uneven terrain with a transverse slope of more than 9 percent | | | | |
| at a constant slope | | | variable slope | | at a constant slope | | | variable slope | |
| 1:4 | 1:3 | 1:2 | 1:1.5;  1:1.75 | 1:1.75;  1:2 | 1:4 | 1:3 | 1:2 | 1:1.5;  1:1.75 | 1:1.75;  1:2 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Category I highways with 8 lanes | | | | | | | | | | |
| 1 | 80/67/86 | - | - | - | - | 116/147 | - | - | - | - |
| 1.5 | 80/71/98 | - | - | - | - | 120/151 | - | - | - | - |
| 2 | 80/66/110 | - | - | - | - | 124/155 | - | - | - | - |
| 3 | 80/74 | - | - | - | - | 132 | - | - | - | - |
| 4 | - | - | 80/66 | - | - | - | - | 88 | - | - |
| Category I highways with 6 lanes | | | | | | | | | | |
| 1 | 73/59/78 | - | - | - | - | 102/133 | - | - | - | - |
| 1.5 | 73/63/90 | - | - | - | - | 106/137 | - | - | - | - |
| 2 | 73/67/102 | - | - | - | - | 110/141 | - | - | - | - |
| 3 | 73/66 | - | - | - | - | 118 | - | - | - | - |
| 4 | - | - | 73/58 | - | - | - | - | 78 | - | - |

*Note:*

a) if the numbers in the table of this appendix consist of three digits:

No. 1 determines the width of the land adjacent to the lane on both sides, taking into account the condition of providing a side view, from 25 m for category I-III roads and from 15 m for category IV-V roads;

Number 2 determines the width of the lands, determined by the organization of furrows;

Number 3 - the width of roadside reserve lands with a width of more than 10 m and a depth of 0.5, 1.0 and 1.5 m, respectively, determined by their calculation, if they are a permanent structural element of the earth embankment.

b) when the digits in the table of this appendix consist of two digits:

No. 1 determines the width of the determined lands, including lands adjacent to the lanes on both sides, from 25 m for category I-III roads and from 15 m for category IV-V roads, taking into account the condition of ensuring lateral visibility;

Number 2 determines the width of the lands, determined by the organization of furrows.

c) when the digits in the table of this appendix consist of one digit:

This number, taking into account the condition of providing a view from the side, determines the width of the determined lands, including lands adjacent to the traffic lane on both sides, from 25 m for category I-III roads and from 15 m for category IV-V roads.

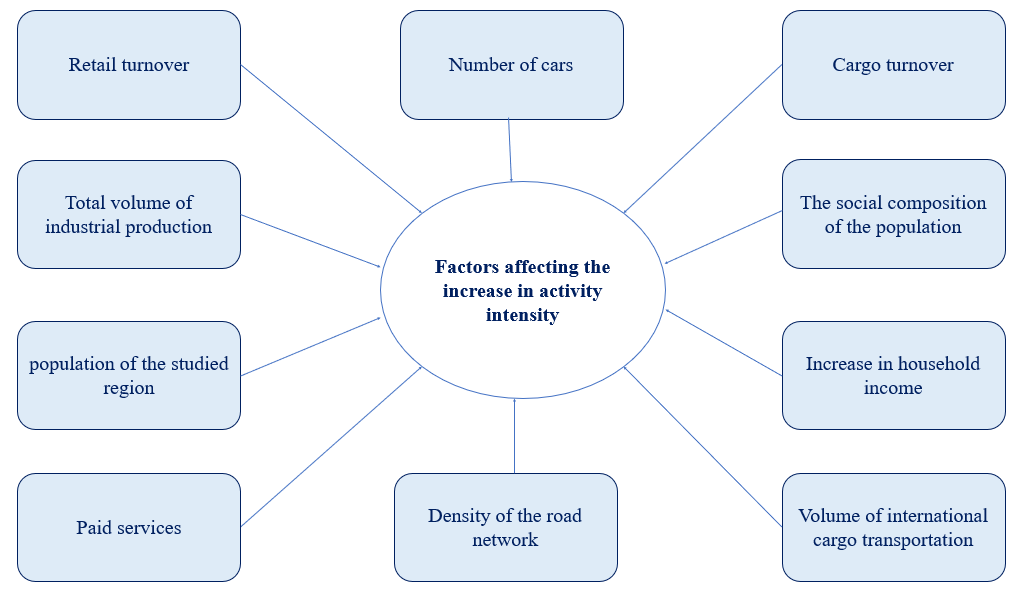
As a result of the sharp increase in traffic intensity on the highway in recent years, it is necessary to change the width of the zone allocated for highways. This can also be seen in the table below (Table 3).

**TABLE 3.** Change in the width of the zone allocated for highways

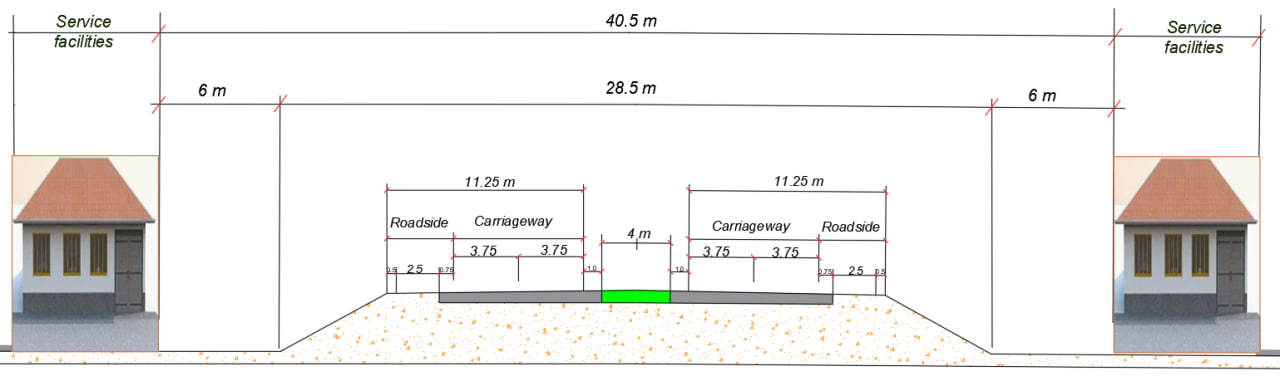
|  |  |  |  |
| --- | --- | --- | --- |
| Road category | Resolution of the Council of Ministers of the RSFSR dated September 26, 1962 No. 255 | Resolution of the Government of the Russian Federation No. 717 of September 2, 2009 | According to the regulatory document SHNK 2.10.01-23 "Determination of land plot dimensions for the construction of flat and linear structures" |
| I | 39 m | 67 m | 65 m |
| II | 28 m | 52 m | 58 m |
| III | 22 m | 35 m | 57 m |
| IV | 19 m | 29 m | 36 m |
| V | 18 m | 27 m | 35 m |

RESULTS AND DISCUSSION

Traffic intensity plays a crucial role in determining the width of the land strip allocated for highways. In recent years, increased traffic volumes have led to congestion on many roadways. The rise in traffic intensity is strongly correlated with the population growth of the surrounding region, the increase in gross regional output, and the annual growth in the number of privately owned vehicles (Fig. 1). When defining the width of the allocated zone, the number of traffic lanes is established based on the level of traffic intensity. Consequently, lane count serves as a primary factor in determining the appropriate width of the highway land strip [12, 13].



**FIGURE 1.** Factors influencing the growth of movement intensity



**FIGURE 2.** Current state of the allocated zone of the M39 highway along the Tashkent-Chinaz route

|  |  |
| --- | --- |
| a) | b) |
| c) | d) |

**FIGURE3**. a) Population and vehicle growth indicators across the Republic of Uzbekistan; b) The composition of the traffic flow identified on the 837 km section of the M39 "Almaty-Bishkek-Tashkent-Shakhrisabz-Termez" highway (average annual daily traffic volume: 53,909 vehicles per day); c) Changes in population and vehicle numbers over the years in the area traveled by kilometers 837-871 of the M39 highway along the Tashkent-Chinaz route; d) Changes in passenger traffic and passenger turnover over the years in the area covering kilometers 837-871 of the M39 highway along the Tashkent-Chinaz route

The roadbed is in the form of a trapezoid, the base of which B0 for a horizontal road section is determined as follows [14, 15].

(1)

here: B - width of the roadbed, m; H-height of the embankment or depth of the excavation, m; m-coefficient of slope steepness.

If the roadbed is on a steep slope, it is calculated using the following expression:

(2)

here: n-slope inclination of the location.

Taking into account the indicators directly and indirectly affecting the width of the zone allocated for the highway, the following expression was developed:

(3)

here: B- width of the strip allocated for the highway, N- traffic intensity; P- population growth; GDP- gross output of the region; - passenger turnover on roads; - number of passengers transported by automobile transport.

The dimensions of the width of the strip allocated for the highway consist of the following composition:

(4)

here: -the width of the road, m; Bt - width of the moving lane, m; n - number of lanes; Bat - width of the dividing strip, m; Byy - width of the road shoulder, m; Bya - width of the side ditch, m; Byy- road side slope, m; k - coefficient taking into account the terrain; Byk -width to ensure side visibility: 25 m for roads of categories I-III, 15 m for roads of categories IV-V.

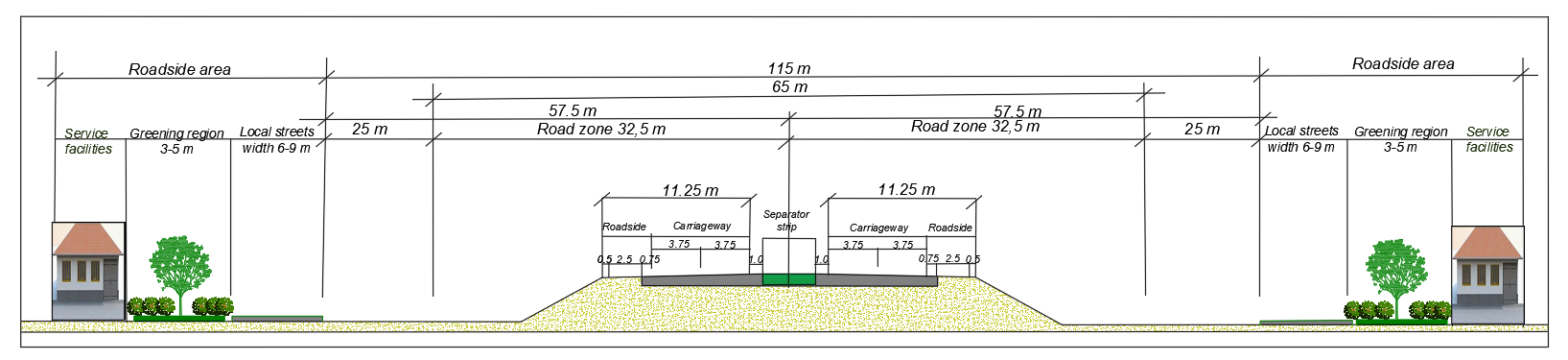
When determining the width of the zone allocated for highways, the influence of the terrain of the area where the highway is located is of particular importance, therefore, taking into account the slope gradient of the highway zone in Table 34 of the regulatory document SHNQ 2.05.02-2007 "Avtomobile Roads" in the case of a highway passage on embankments and in the case of a trench passage in Table 35, a coefficient for the change in the zone allocated for highways was developed [15, 16, 17, 18, 19].

**TABLE 4.** When the highway passes on the embankment

|  |  |
| --- | --- |
| Embankment soils | k |
| Large fragments of low-weathering rocks | 1.54 |
| Coarse-grained and sandy (excluding fine and dusty sands) | 1.62 |
| Fine and dusty sands, clay and loess soils | 1.62 |

**TABLE 5.** When the highway passes through a slot

|  |  |
| --- | --- |
| Carved soils | k |
| Rock formations: - low-weathering   * Easily weathered: * those who don't soften in water * softening in water | 1.66  1.62  1.2  1.2-1.31 |
| Large-lobed | 1.62 |
| Homogeneous hard, semi-hard, and difficult-to-soften clayey and sandy | 1.62 |
| Fine sand dunes | 2.66 |
| Loess | 1.2 |



**FIGURE 7.** The width of the designated and safety zone for Category I highways

CONCLUSION

When determining the width of the land zone allocated for highways, the geometric parameters of the road play a particularly significant role. These parameters are closely associated with the number of vehicles required to ensure safe traffic flow. In this context, the concept of a “safety zone” along the side boundaries of the allocated strip is defined in Cabinet of Ministers Resolution No. 342 dated December 26, 2011. The resolution establishes specific width requirements for safety zones: for roads of categories I and II — 25 meters, for category III — 20 meters, and for roads of categories IV and V — 15 meters [5].

The width of the zone allocated for the highway requires a comprehensive approach. The geometric dimensions of the road, terrain, safety requirements, and other factors must be taken into account together. When determining the width of the zone allocated for highways and in the process of its cadastral registration based on legislation, it is necessary to take into account the active use for the placement and development of the highway and its service facilities located in this area [20, 21, 22, 23, 24]. This, in turn, requires a sufficient justification in search and design work of the economic development of territories in the development of road infrastructure, the rapid increase in traffic volume, which is the main indicator determining the number of lanes of highways.

**FUTURE SCOPE**

The study on highway zone widths in Uzbekistan can be continued in the future by work on enlarging the methodology on how best to come up with peak dimensions in line with the present and future trends of road usage. Seeing the rate at which the intensity of traffic is growing, the population base is expanding as well as the expansion of the local infrastructure, a necessity occurs to have dynamic models of land allocation based on real-time information.

This can be followed through in one direction with respect to development of the intelligent GIS-based systems that automate and optimize the process of designing and monitoring of road zone widths. These systems may combine traffic sensors, satellite images and demographic information to accommodate zone controls that change with practice and environmental limitations.

Also, more investigations should be conducted to evaluate the economic and environmental consequences of having too wide or too narrow zones, particularly in urban and ecologically-sensitive locations. The comparative studies with the international standards could be useful in presenting the practical wise approach in the balance between the development of infrastructures and the conservation of the land resources.

Simulation modeling is also a possibility, in which simulation of safety of the road design and land usage over a long period can be predicted by using Finite Element Analysis or machine learning on different geometric and terrain parameters. Such models are able to inform the transportation planning efforts by helping planners and policymakers make informed decisions, regarding expansion of roads and safety buffer zone as well as integration of roadside service facilities.

Lastly, it would be desirable to align national norms (like SHNQ 2.10.01-23) with the best global practices and create some adaptive guidelines that would allow to adapt to the specifics of socio-economic and geographic environment of Uzbekistan. Working out performance-based standards as opposed to strict dimensional standards may enable future road infrastructure projects to be more innovative and sensitive in the future.

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