



## Ensuring The Safe Movement of Vehicles on Mountain Roads

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### ABSTRACT

This article discusses the features of traffic on mountainous sections of roads in the conditions of the Republic of Uzbekistan, analyzes the intensity and composition of traffic flows, features of road conditions, traffic accidents

### Keywords:

Intensity, road traffic accidents, ascent, descent, emergency exit, braking, roads, limited visibility, overtaking, longitudinal slope, subgrade, steep descent, speed on the slopes, curves of small radi.

*Motorization and development of the republic's economic sector leads to a rapid increase in the intensity of transportation on mountain roads. In many cases, these roads do not meet the traffic requirements of modern vehicles, which leads to a decrease in the efficiency of transportation and an increase in accidents. The peculiarities of the position of roads in difficult mountainous terrain conditions significantly affect their transport and operational characteristics, working conditions for drivers and traffic safety.*

The increasing volume of traffic and the massive attraction of automobile tourists to mountainous areas make it necessary to improve methods for designing mountain roads in such a way as to maximize their throughput and technical qualities, without significantly increasing the cost of construction.

It is impossible not to take into account that many of the roads currently in use were

built during a period when the builders did not have the equipment characteristic of modern construction. Their radical restructuring is associated with an almost complete abandonment of the existing route, which was done on the A-373 "Tashkent-Andijan-Osh" highways in sections 116-196 km. to Rezaksky and Kamchiksky passes.

Traffic safety conditions in the mountainous conditions of Uzbekistan, in view of the problematic implementation of new construction projects due to the complexity of the terrain and financial difficulties, pose the task of selective reconstruction of sections of roads of the existing network.

It is impossible to subject all mountain roads to such a restructuring in the near future. Therefore, it is important to develop simpler construction and organizational measures that would improve the safety of mountain roads.

Consequently, to improve traffic safety along a mountain road, the widespread use of

means and methods of organizing road traffic, allowing not only to streamline traffic, but also to increase its safety and efficiency, becomes of great importance and relevance.

Highways in Uzbekistan, ranging from 10 to 20% of their length, pass through mountainous areas and have a number of features compared to roads passing through flat areas. Uzbekistan is a mountainous country by the nature of its surface, with absolute altitudes ranging from 300 to 2260 m above sea level.

The republic's acquisition of sovereignty and independence, as well as the ongoing political events, posed new challenges for industry, agriculture, and no less for the transport system.

In the Republic of Uzbekistan, reconstruction and construction of new roads in mountainous areas have been widely carried out in recent years. A typical example of modern work is the reconstruction of a category I road through the Kamchik and Rezak passes, connecting the southern and northern parts of Uzbekistan.

Mountain roads differ significantly from flat roads in technical characteristics that affect traffic safety: steeper slopes, smaller turning radii, serpentines, frequently repeated turns in different directions, short length of horizontal sections, unworthy places for safe stopping, parking, less visibility on some roads. areas, the possibility of blockages, landslides, washouts, rockfalls, difficulty in maneuvering when necessary, a sharp rise in water levels in rivers located close to the roadway, cliffs, etc.

As a rule, roads built in mountainous areas differ significantly in the transport and operational characteristics and traffic modes of roads in flat and hilly areas. The conditions for the movement of cars along them are determined both by the features of the plan and longitudinal profile, and by the influence of changing climatic conditions as one rises above sea level. The air temperature in the mountains is lower than in the valleys. Air pressure decreases with altitude.

In conditions of relatively low altitude passes, the influence of air rarefaction is not noticeably manifested in cars with carburetor engines; the dynamic factor decreases at such

an altitude by no more than 10-15%. In Uzbekistan, this circumstance significantly affects the conditions of road transport on mountain roads A-373 "Tashkent-Andijan-Osh" on the section 116-196 km, where the Kamchik Dovoni pass is located, the highest in the republic, rising 2260 m above sea level.

When designing and constructing a road and organizing traffic safety in mountainous areas, it is necessary to carefully take into account the features and diversity of the terrain, which consist mainly in the following: complex geological structure, alternating rock layers of different thicknesses, slopes of varying steepness. Low stability of the roadbed on slopes, significant amplitudes of daily temperature fluctuations, rock weathering processes, the intensity of which depends on the location of the mountain slope in relation to the cardinal directions, the need to overcome large differences in heights, the presence of numerous mountain streams, frequent snow drifts, the presence of unstable mountain slopes ( landslides and screes), which are activated by road construction. In high mountain areas, winter ice may form due to the release of water that has accumulated over the summer in the loose surface layers of soil above the road. Choosing a route in mountainous areas requires an in-depth preliminary study of geological and hydrogeological conditions on the slopes and in the valleys of rivers and mountain streams, and solid sediments [1].

Sections laid along mountain slopes are characterized by maximum longitudinal slopes and the development of a route along the slopes with the introduction of steep horizontal serpentine curves. To ensure the stability of the roadbed, it is often necessary to provide special structures - retaining walls, a device to protect the road from snow and falling stones for round-the-clock travel through passes located high above sea level and heavily covered with snow; anti-avalanche and anti-rockfall structures are installed above the pass on the way. An example of such a solution is the tunnel designed by Uzbek engineers at the Kamchik Dovoni pass. Choosing the option with a tunnel or passing directly through the pass

with enhanced winter maintenance requires detailed feasibility studies, comparison of capital investments, operating costs for road options.

To clarify the parameters of road conditions, the project of the Tashkent-Andijan-Osh highway on the section 116-196 km was analyzed. A number of features of the road conditions in the study area, many concave curves are less than the minimum dimensions of the radius of the curves given in SN and P 2.05,02-95 "Highways", and numerous convex curves also do not comply with the standards.

For a category I highway in mountainous conditions, it is recommended to assign longitudinal slopes of no more than 50, however, data analysis shows that in many sections of the Tashkent-Andijan-Osh road it exceeds the permissible norms of longitudinal slopes.

According to the recommendations of SN and P, with longitudinal slopes of more than 60%, it is necessary to provide the possibility of short-term stopping of cars every 2-3 km, for which purpose areas with longitudinal slopes of up to 20% and a length of at least 60 m are arranged or special areas for longer stopping, which are widening of the roadway [1-3].

It should be noted that currently, dangerous goods such as petroleum products are transported on heavy trailers along the Tashkent-Andijan-Osh transfer route. The movement of road trains with dangerous goods greatly complicates the traffic conditions of other vehicles on uphill sections of mountain roads. In general, the implementation of safe transportation of goods and passengers along mountain roads requires research into the conditions of traffic flows on various sections of roads [4-5].

When analyzing road accidents, we used data from registration cards about 150 incidents on a number of four-lane highways with a total length of 52 km (144-196 km), located on an area with different terrain.

The peculiarities of weather and climatic conditions in mountainous areas and the difficulty of maintaining roads in the winter and autumn-spring periods cause uneven

changes in traffic intensity throughout the year and, as a result, sharper fluctuations in accident rates than on flat roads.

A comparison of the obtained distribution curves of accidents by month with the average data for the pass shows that mountain roads are characterized by an abrupt increase in accident rates in the fall, due to an earlier increase in traffic intensity and unfavorable weather conditions, primarily large amounts of precipitation, which reduces the adhesion qualities of the surface. At the same time, the severity of the consequences of accidents in the winter and spring periods is lower than in the summer, due to lower average traffic speeds.

However, in general over the year, the severity of the consequences of accidents on mountain roads is 2.0 times higher than on flat roads.

The analysis shows that almost 80% are oncoming collisions, rollovers, pedestrian collisions and obstacles. These four types of incidents are also characterized by the greatest severity, which is more than many times higher than the other types [2].

It should be noted that the analyzed registration cards did not allow us to completely restore the picture of the occurrence of the incident due to the lack of a strict link to the road conditions completely. The kilometer and picket of the scene of the incident, the direction of movement of vehicles, types of violation, age, length of service and work of the driver behind the wheel were not recorded. Therefore, it is difficult to change the role of road factors, in particular the geometric parameters of roads, only on the basis of information contained in registration cards.

The main causes of incidents grouped according to the official traffic police classification are vehicles driving into oncoming traffic and excessive speeds (12%). Both of these reasons are interrelated and reflect the developed driving style of a significant part of drivers on mountain roads, cutting off large turns and using almost the entire width of the roadway.

Therefore, driving at speeds that do not correspond to real road conditions is

associated with an increased level of neuro-emotional tension of drivers and, as a consequence, the rapid onset of fatigue and decreased performance. Analysis of incidents shows that the relative accident rate on mountain roads increases after 2-4 hours of the driver being behind the wheel.

The highest relative number of accidents is characterized by straight sections of mountain roads with small longitudinal slopes (up to 20%). These areas are intended for overtaking slow-moving vehicles that accumulate in areas with insufficient visibility or on small radius curves. Overtaking several cars at once, which is often performed by drivers (15%). Accidents arising from non-compliance with overtaking rules occur on straight horizontal sections of mountain roads; the main types of accidents are oncoming collisions. Along with straight sections, descents combined with curves in plan are no less dangerous. The main type of incident here is vehicle rollovers due to excessive speed and loss of vehicle stability.

As follows from the study, plan curves are also very dangerous in mountainous conditions, the main types of accidents in which are oncoming collisions (50%) and rollovers (32%). These accidents were caused by driving around or under the curve, or at a speed that was inconsistent with the curve parameters. Steep climbs, due to the limited dynamic capabilities of cars, are much less dangerous than descents [2].

Particular difficulties for traffic arise in pass areas, especially when the traffic flow includes heavy vehicles and road trains. The analysis found that they accounted for about 34% of accidents, while such vehicles accounted for no more than 10-15%. It should also be noted that material damage from road accidents on mountain roads is much higher [6].

The occurrence of road accidents is promoted not by one, but by several factors acting simultaneously. Such reasons may be curves of small radii in plan, limited visibility, insufficient width of the roadway on curves, lack of sufficient information for drivers about the direction of travel, lack of roadway markings, and weather conditions.

Analysis of accident rates on pass sections of mountain roads made it possible to determine the patterns of accidents on the following characteristic sections of roads [7].

1. Curves of small radii, the main types of accidents in which are oncoming collisions (50%), about the main reasons for cutting the curve and rollover of vehicles (32%), arising due to the discrepancy between the selected speed.
2. Sections of roads with large longitudinal slopes (from 50‰ to 80‰). Dangerous descents combined with curves in plan (20‰) where the main types of accidents are vehicle rollovers. They are caused by excessively high speed when driving around curves. On steep slopes, accidents are most often observed when driving into oncoming traffic while overtaking.
3. Sections of roads with limited visibility in plan or longitudinal profile. The occurrence of accidents is facilitated by driver errors when overtaking, associated with the incorrect choice of interval in oncoming traffic.
4. In general, on pass sections, 85% of incidents are oncoming collisions and vehicle rollovers.
5. Comparison of the distribution of road accidents with changes in traffic intensity by hour of the day on pass sections shows that with an increase in traffic intensity, the number of road accidents also increases.

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