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MOUNTAINOUS REGIONS OF THE WORLD AND THE REGULARITIES OF THEIR ROAD NETWORK DVELOPMEnt

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Resume.
The article discusses the mountainous regions of the world and the level of development of their road network, the natural conditions affecting the routing of highways, the regularities of the formation of the geometrical elements of the road. It is shown that the influence of the terrain on the routing of highways is identical for all mountainous regions, and the received recommendations can be used for all mountainous regions, road plan and profile types with quantitative characteristics are shown in different terrain conditions.
Key words: location relief, track, road plan, longitudinal profile of the road, environmental protection, infrastructural measures. Introduction.

Introduction.

Mountainous terrain is part of the territory of many countries of the world. A significant part of the road infrastructure of the countries of the European, Asian and American continents is built in mountainous terrain, and their transport and operational characteristics differ greatly from the similar indicators of highways built in flat and hilly terrain.

Mountainous regions on the European continent are: Crimea, Carpathians, Caucasus, Alps, Pyrenees, Scandinavian mountains, Balkans.

The network of highways built in the territory of Italy, Germany, Norway, Spain (Catalonia, Basque Country), Austria and Switzerland is distinguished by the high transport operational qualities of these regions.

The mountainous part of the North American continent is characterized by the most difficult terrain and seismic tension. The northwestern part of its territory stretches from Alaska to Guatemala. The highways of federal and state importance in the territory of the United States of America have particularly high traffic operational properties.

The most important mountainous region on the South American continent is the Cordillera, which extends from Colombia through Ecuador and Peru to the extreme south of Chile. The road network located here is characterized by very difficult terrain and natural conditions and mainly stretches from north to south.

The highways of international importance going from the west to the east connect to the flat areas located in the lowlands of Brazil, Argentina, Uruguay and Paraguay through the passes located at 2.5-3.5 thousand m.

The largest area of Asia is mountainous and mountainous. The Anatolian Peninsula, the South Caucasus, Asia Minor, the Iranian Plateau, Altai, Kamchatka, and the Japanese islands are mountainous. High mountain parts are: Caucasus Mountains, Pamir, Tianshan and Hindikushi. International highways connecting many countries are located on these territories, which have great economic and military-strategic importance.

Turkey, Iran, the countries of Asia Minor, Georgia in the South Caucasus, and China in the eastern part of Asia are distinguished by a relatively high level of development of the road network. The road infrastructure of Japan is the most developed, where many thousands of km. The highway is laid in the most difficult geography, seismically active and landslide regions.

The largest part of the African continent is mountainous. especially its southern and eastern part. Ethiopia, Kenya, Angola, South Africa

North Africa and the territories of Algeria, Tunisia and Morocco are also mountainous. road infrastructure is developed to a sufficient level in Algeria and Tunisia, as well as on the island of Madagascar. The Republic of South Africa has a high level of infrastructure. In the rest of the territories, the road network is not sufficiently developed, and its deficiency causes great damage to the economy of the countries located there.

The territory of Georgia is mountainous, except for the Kolkhidi plain, the eastern part of Mtkvari valley, Alazni and Ivri valleys. International, domesticand local highways of Georgia are located in mountainous and mountainous regions.

Road and railway map of Georgia

The most important part of the Europe-Asia transport corridors is the Red Bridge-Natakhtari-Khasuri-Zestafoni-Kutaisi-Samtredia highway. The Natakhtari Lars highway, especially its sections Mleta-Kobi, Stepantsminda Lars, is of great importance for the country's economy and defense capabilities.

The Pshaveli-Omalo road leading to Tusheti is also very important for the strengthening of the country's defense capability and the economy,

and on the other hand, Barisakho-Shatili, Oni-Ghei-Mamison pass, Lentekhi-Mestia connecting Piraketa Khevsureti.

Main part.

Terrain, geological and hydrological conditions, climate, flora, fauna and other natural factors determine the location of the road axis in space.

Of these factors, only the relief of the location bears the regularity of the arrangement of sharply defined elements, the frequency of repetition of individual forms and independence from other natural conditions. The rest of the natural factors are interdependent, influence each other, change mainly depending on the latitude and altitude. therefore,

it is appropriate to determine the most favorable conditions for classification and tracing, based only on the terrain of the location. In this way, the study of the regularity of the arrangement of individuallandforms, their types, the research thatis most related to the quantitative assessment of the complexity of the sections during laying the track, acquires great importance for the development of

quantitative criteria for rational tracing. visual observation of relief forms, analysis of various

code	plan				
	Graphic image	length of curves %	Number of curves in 1 km	Characterization of terrain	Tracing conditions
1	2	3	4	5	6
1.		7 – 8	0.5-1.5	Fields, wide valleys	Free movement without obstacles
2.		15-30	2-5	hills and deep ravines	Obstacle course
3.		60-80	8-12	mountains	A tense ride with many obstacles

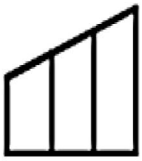
projects, which were used to build highways in mountainous areas with different terrains, showed us that it is possible to distinguish three types of road plan and longitudinal profile, the different combinations of which determine the character of the road axis or track. The study of these regularities was carried out by Prof. K. Mchedlishvili as well as in the works of other scientists. the quantitative characteristics of the track elements, obtained as a result of the analysis of projects carried out in Georgia in recent years, have been clarified by our research. Types of plan and profile elements, their graphic representation and

quantitative characteristics are given in Tables 1 and 2.

The highway track plan
Types in different terrain conditions

As can be seen from the table, type I plan is found in wide, open fields, bar and large upland, plateau. The terrain does not create a significant obstacle for laying the track. In modern projects, which

are made using computer programs, the length of curves has increased on the contrary due to the use of large radii and long transition curves. The magnitudes of the curve elements do not limit the mode of

code	Longitudinal profile							
	graphic image	length of curves %	Number of refractions at 1 km	Limit value of refractions in %	The magnitude of swings in %	Length of permanent rock sections in km	Characterization of terrain	Tracing conditions
1	2	3	4	5	6	7	8	9
A		10-20	2-3	6	1.0-3.5	0.6-1.2	fields, wide valleys	Free movement without obstacles
B		60-75	2-4	15	5-10	0.3-0.5	hills and deep ravines	ride with obstacles
C		3-12	0.5-1.5	4	5-12	0.5-2	mountains	A tense ride with many obstacles

movement. as a rule, sight distance from the overtaking condition is always ensured.

II - type plan - can be found on those sections of the road that are laid out insmall divided main valleys, or in the
valley or bar of the second order, as well as in places with frequent ditches. the elements of curves act on the mode of traffic of vehicles, the vision is provided from the condition of stopping in front of a suddenly appearing resistance.

III - type plan - is found mainly in low-order valleys, on the slopes of ridges, this type of plan is characterized by multiple turns with small radii and increased turning angles, which significantly worsens traffic safety and comfort. In such sections, the sight distance cannot provide a stop in front of the suddenly appearing resistance for the most part. longitudinal
profile type "A" - characteristic of valleys and wide valleys.

Longitudinal profile type "B" can be found in deeply divided potholes, ditches, gullies. The outline of the longitudinal profile of the road coincides with the profile of the location, such a longitudinal profile is characterized by alternating uphill and downhill slopes.

Insufficient sight distance for overtaking vehicles significantly worsens traffic safety and comfort. The existence of such longitudinal profile sections is
due to the desire of road designers to reduce the working marks of cuts and

Longitudinal profile of the highway trackTypes in different terrain conditions

corners in order to reduce the volume of earthworks.
this in a way improves the ecological condition of the environment and dramatically worsens the modes of vehicle traffic and traffic safety.
Longitudinal profile type "C" is found on the slopes of high mountains. Such sections begin where the natural slope of the valley is significantly higher than the normative slopes allowed on the roads. longitudinal profile vision and vertical curves, bends of slopes do not limit the traffic modes of vehicles.

Our study of geometrical elements of highways showed us that in the last 12-15 years there is an obvious trend of increasing track elements, radii, turning angles and longitudinal slopes, which is a good response to the requirements of modern dynamic vehicles. at the same time, we have cases when during the reconstruction of the constructed roads, the track elements of 30-40 years ago are left unchanged, which in combination with the modern type of road clothing and the elements of the road arrangement gives a negative result. When driving at high speed, there is a great danger of road bends, and when driving at low speed, the effectiveness of the funds received for road reconstruction is reduced.

Conclusion.

Our research and the review of existing literature showed us that motor vehicles are one of the main causes of negative impact on nature, namely: non-perfect construction and technical failure of cars, consumption of large amounts of fuel. Vehicle traffic mode in different road conditions
A radical way to improve the situation is first of all to improve the road infrastructure: the selection of the road plan, longitudinal and transverse profile, road surface elements, which in the conditions of low traffic intensity make possible the movement of vehicles with direct or previous transmission. This in turn ensures minimum fuel consumption and emission reduction.

In order to create optimal conditions for the movement of vehicles, traffic safety requirements must first be met. Due to the high level of automobileization in most countries of the world, we can present these requirements in two constituent parts: protection of traffic participants from bodily injury and protection of the environment and people from ecological problems created by road traffic. in turn, we can distinguish three directions in environmental protection:

Environmental protection from toxic substances emitted from hot engines, wear

products of tires and tires, noise and vibrations.

Infrastructural measures and protection of natural factors from high bends on roads, deep cuts and significant intrusions on slopes; Protection from landslides, rockfalls and avalanches by drawing appropriate transverse profiles in space along the axis of the road and by selecting the types and sizes of artificial structures. Protection of the environment by the methods and means of traffic organization.

Visual observation and analysis of existing data showed us that the terrain of the mountainous region of the world and the influence of other natural conditions on highway routing (geology, climate, hydrology) are completely identical. there is the same regularity everywhere, the transition from a wide field to a relatively narrow river valley and further uphill to the pass, the road plan and longitudinal profile types are also identical. accordingly, the research conducted in any mining region about the conditions of tracing, the modes of vehicle traffic and the transport and operational characteristics of roads are valid for other regions.

Therefore, we can use the methods of evaluating traffic operational conditions and the criteria used to compare options (environmental friendliness, economy, safety) for all regions, but with certain adjustments, which are of no fundamental importance from a methodological point of view.

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