

# STUDY OF THE INFLUENCE OF WEATHER AND CLIMATE CONDITIONS ON ROAD TRAFFIC SAFETY IN THE FERGANA VALLEY AREA

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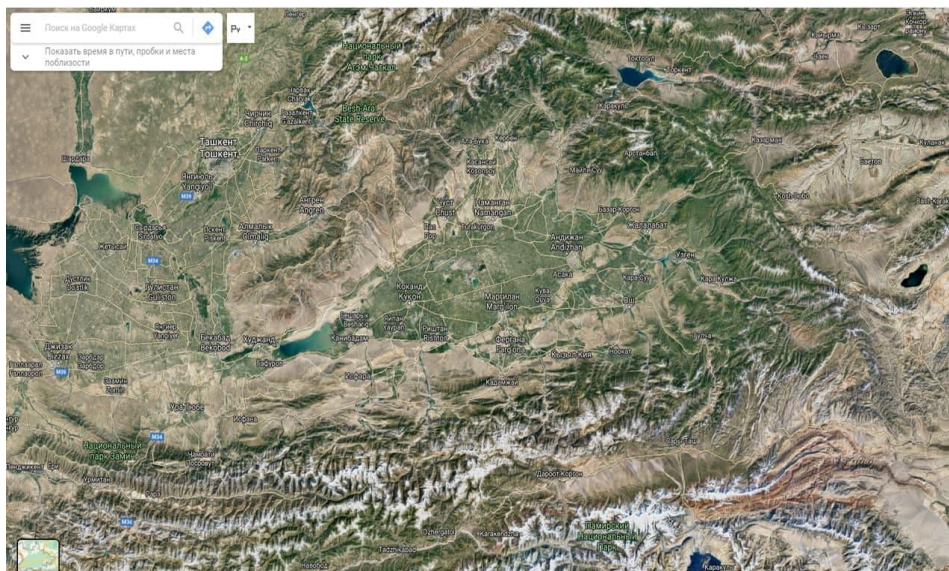
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**Abstract.** *The effect of the air-climate conditions of the Fergana Valley on road safety is studied. Fergana Valley is located among the mountains of Central Asia and is considered one of the largest mountain ranges (valleys) of Central Asia. It is surrounded by Tianshan and Hisar-Olai (Turkestan) mountain ranges in the north, Kurama and Chatkal mountain ranges in the north-west, and Fergana Mountain range in the north-east. The Fergana Valley is mainly located in the territory of the Republics of Uzbekistan (Namangan, Andijan, Fergana regions) and partly in the Republics of Kyrgyzstan (Osh, Jalalabad, Batken regions) and Tajikistan (Khojand region). The total area of the Fergana valley is 22 thousand km<sup>2</sup>, including the surrounding mountains, it occupies an area of 78 thousand km<sup>2</sup>, it stretches from west to east for 475 km, from north to south for 265 km.*

**Keywords:** *traffic safety, weather and climate factors, road conditions, metrological indicators, road traffic incidents.*

## Introduction

Narrow in the west corridor (8-10 km wide) connected with the Tashkent-Mirzachol bog through the "Khojand Gate" (Figure. 1) [1].



**Fig. 1.** *A satellite view of the general area of the Fergana Valley.*

In Uzbekistan, the valley covers Fergana, Andijan and Namangan regions, is 300 km long, 60-120 km wide, 170 km wide at its widest point, and has an area of 19,200 km<sup>2</sup>. Its height above sea level is 330 m in the west and 1000 m in the east, and its general structure is elliptical (almond) shaped and widens from west to east [2].

The territory of the republic is 448.9 thousand km<sup>2</sup>, of which the territory of the Fergana Valley (Andijan, Fergana, Namangan regions) is 19.2 thousand km<sup>2</sup>, i.e. 4.2%. The population of the republic is more than 35 271,276 thousand people, of which the share of the population of the Fergana Valley is 10 010,405 thousand people, i.e. 29%. Including, the length of the total road network of our Republic is more than 209496 km, of which the road network of Fergana Valley is 47307 km or 23% (Figure. 2) [3].

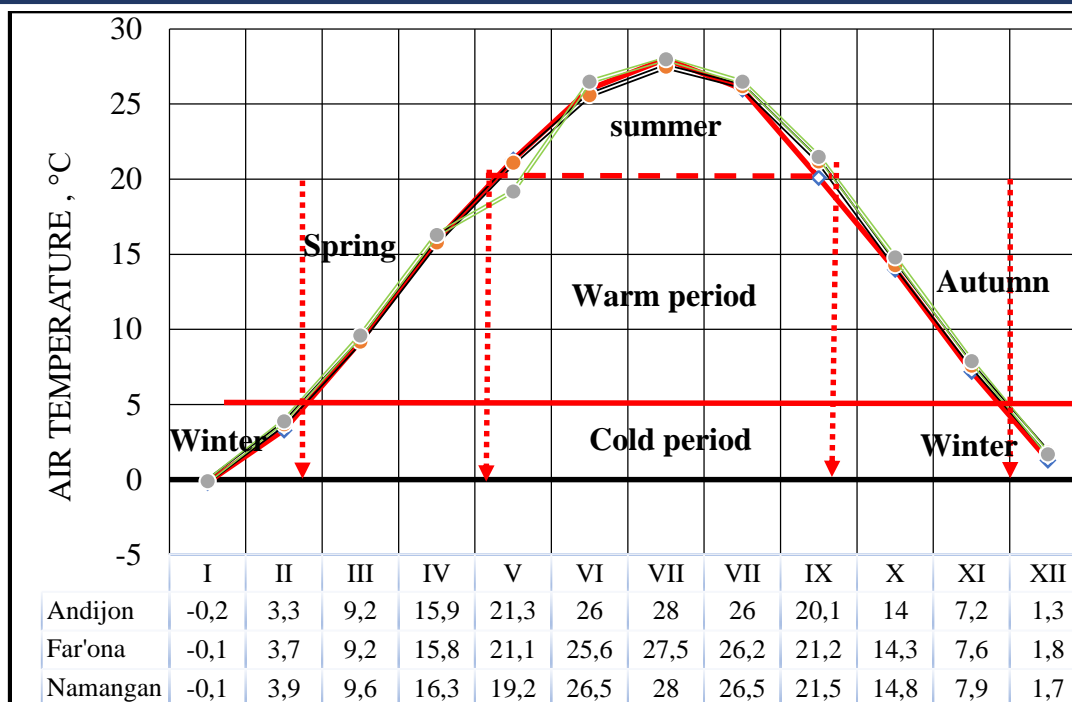


**Fig.2. Fergana Valley road network map**

Fergana Valley is one of the regions with a high road network and high population density. The density of the road network is 2.46 km/km<sup>2</sup>, and the population density is 538.8 people/km<sup>2</sup>. European countries in terms of the density of the Fergana Valley road network (1.99 km/km<sup>2</sup> in France, 1.80 km/km<sup>2</sup> in Germany, 1.62 km/km<sup>2</sup> in Italy, 1.35 km/km<sup>2</sup> in Spain km<sup>2</sup>) is greater than the density of the road network. A map of the Fergana Valley highway network is presented below (Figure 2) [4].

In researching the influence of air-climate conditions on road safety in the Fergana Valley region, we consider the climate conditions. Summer is hot and dry, the average temperature in July is +26 °C +27 °C, and the hottest temperature it reaches +43 °C +44 °C. In the Fergana valley, the period of vegetative development (vegetation) lasts 230-240 days, and the total sum of temperature is 4400-4800°C. Fergana's average winter, average summer and average annual temperatures are lower than in several parts of Uzbekistan. For example, the average annual temperature in Tashkent is 13.3 °C, in Mirzachol 13.2 °C, in Termiz 17.0 °C It is 15.1 °C in Bukhara, 15.8 °C in Karshi, and 13.0 °C in the Fergana Valley [5].

In the studies, when the influence of the air-climate factor on the driving conditions of cars is studied, the year is divided into 3 different periods, i.e., winter, spring-autumn and summer periods, and their seasonal periods are presented (Figure. 3) [6].



**Fig. 3. Seasonal periods of the year according to traffic conditions in the Fergana Valley**

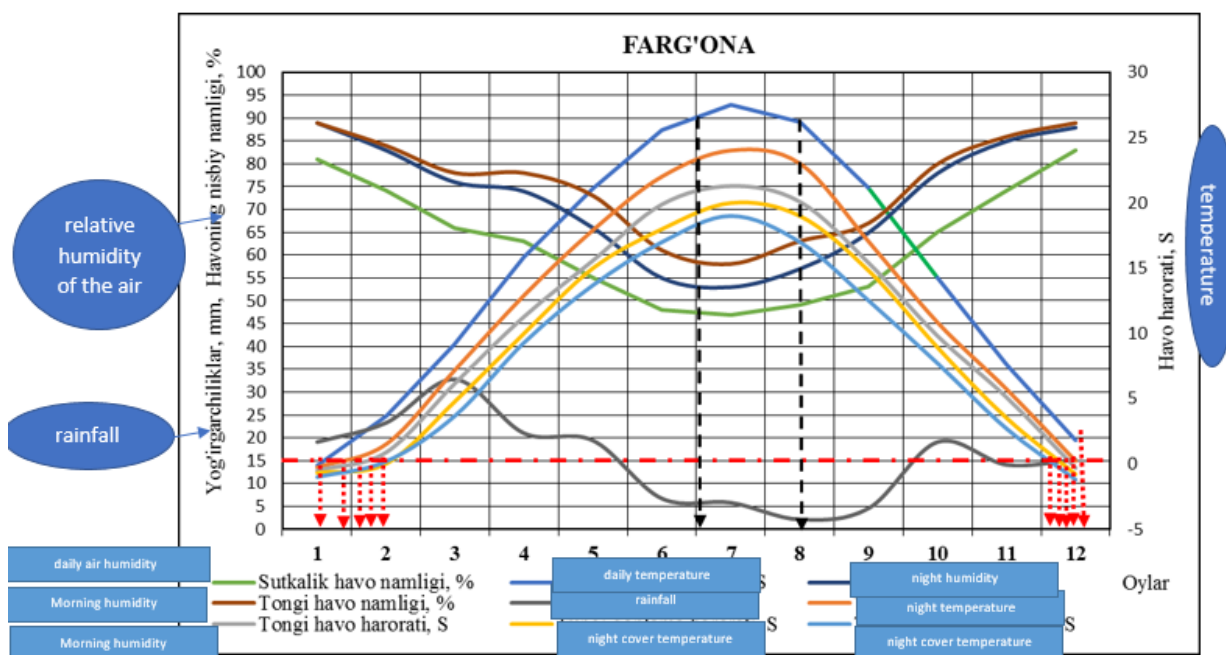
The climate of the Fergana Valley is divided into hot and cold periods (2 -pictures). Days with an average daily temperature °above +5 C are included in the warm period, and °days below +5 C are included in the cold period. The warm period is divided into early-spring (S, +5 °C ≤T ≤+20 °C), mid-summer (Sum, T >+20 °C) and late-autumn (Au, +20 °C ≤T ≤+5 °C) seasons and the cold period <corresponds to the winter (W, T +5 C) season [7].

Air-climate conditions, it is important to determine the duration of its effect, because the effect of some indicators of air-climate conditions continues even after the event is observed. For example, the effect of precipitation lasts until the coating dries, that is, the time of its melting after snow, the duration of the construction of the coating after rain, etc. Studies have shown that its effect lasts up to 5 hours after rain [8].

An increase in air temperature leads to a change in the microclimate at the driver's workplace, a decrease in the driver's ability to work, and an increase in the number of errors. When the air temperature was +16+23 °C, the driver's reaction time was 971 ms, and at +27 °C it was 1281 ms, that is, the reaction time increased by 32% [9].

The air temperature was from +16 °C to +23 °C, 88 accidents occurred in 100 days, and 238 accidents occurred when the air temperature was higher than +27 °C. Studies show that the most comfortable air temperature for driving conditions is between +16°C +23 °C. Seasonal periods in which the most favorable air temperature occurs in the republic and their duration were determined as a result of research (Figure. 4) [10].

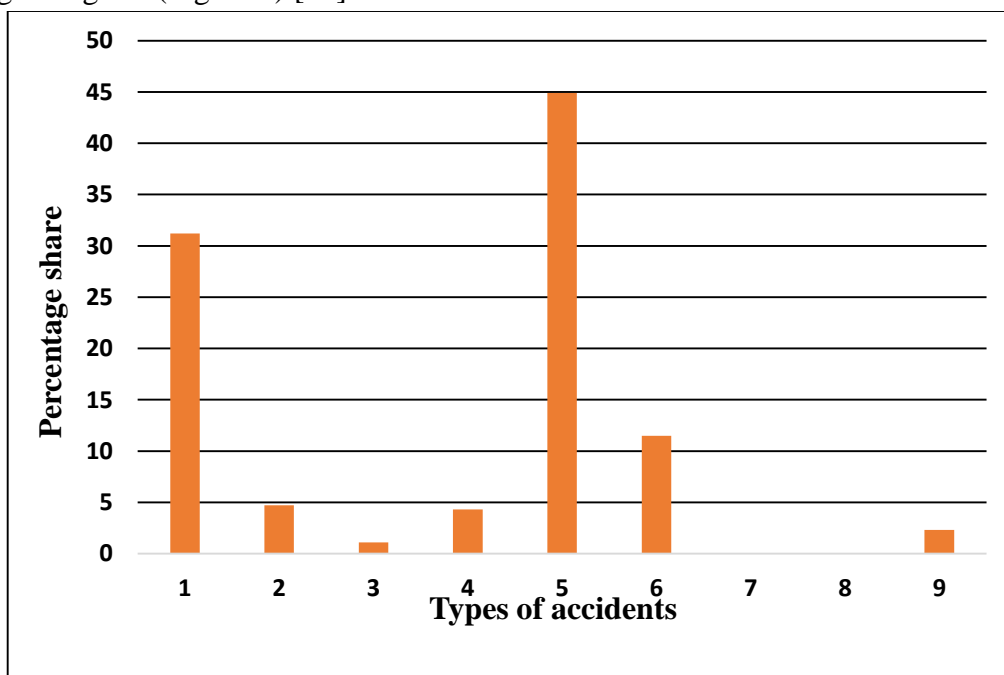
Based on the above information, when the air temperature exceeds +27 C, the comfort of driving conditions decreases and an uncomfortable working environment for the driver occurs. A decrease in air temperature below 0 °C causes the formation of slush and microslush when the top surface of the coating is wet, the coefficient of friction of the coating with the wheel decreases and, as a result, unfavorable driving conditions occur [11].



**Fig. 4. Fergana's air-climate conditions complex graph**

Intensity and duration of occurrence of meteorological factors are different in different regions. A feature of weather and climate changes in the Fergana Valley region is that highways with the same technical characteristics can be used at high speed in some areas throughout the year, and in others, we can observe comfortable and safe traffic on the same roads. In certain periods of the year, traffic is observed at a reduced speed and with an increase in the number of traffic accidents [12].

When analyzing the last 10 years of traffic accidents both in the Republic and in the Fergana Valley, mainly 5th type "Hitting a pedestrian with a car" 44.9% and 1st type "Car crash" 31.2%, 6th type "Hitting a cyclist with a car" is the most common type of accident, such as 11.5%. The analysis of the occurrence of accidents in the Fergana Valley by types is shown in the following histogram (Figure 5) [13].



**Fig. 5. Distribution of accidents by types in the Fergana Valley**

When analyzing the reasons for the occurrence of accidents, 13.1% showed the absence of roadblocks, 11.6% did not install group 2 pedestrian barriers, and 10.3% did not have a pedestrian crossing, unsatisfactory road conditions in 4.1%, bicycle lanes not organized in 3.5%, traffic lights or road signs not installed in 2.2%, other objective reasons in 3.3%, the hitting speed limit in 15.8%, inexperience of the driver in 10.6%, failure to follow a traffic light or road sign in 8.5%, driving a vehicle without a driver's license in 5%, 3.5% fatigue and sleepiness in 3%, drunk driving in 3% and other subjective reasons in 5.5% [14].

From the analysis of accidents on Fergana Valley highways in the last 10 years, it can be said that the fatality rate is high on the international highways A373 and state highways 4R112. Highway 4R112 is considered the ring road of Fergana Valley and connects Fergana, Andijan and Namangan regions. A373, 4R112, 4R115, 4R126, 4R140, considered the main highways of the Fergana Valley, were selected as research objects for experimental research work.

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