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Kabenov O.T., master's student

Ibraev A.S., Ph D, senior lecturer

Overchenko G.I. Ph D., associate Professor

West Kazakhstan agrarian and technical university after Zhangir Khan, Uralsk

**ASSESSMENT OF THE ORGANIZATION OF PEDESTRIAN TRAFFIC AT THE
INTERSECTION OF ROADWAYS**

Abstract

The organization of pedestrian traffic is one of the most urgent problems. A large number of road accidents involving pedestrians are caused primarily by conflicts between road users when crossing the roadway. Road accidents involving pedestrians are of great social significance, as they are associated with the death or injury of people. The organization of the movement of pedestrians can be performed on sidewalks along the roadway or when crossing. The latter type of pedestrian traffic is the most dangerous. Crossing the roadway is carried out at pedestrian crossings of various types and different degrees of equipment with technical means of traffic control. Both pedestrians and drivers of vehicles have an impact on the risk of a road accident. But mostly they are caused by pedestrians. The reasons for this is the transition of the roadway to a forbidding traffic light signal or in the wrong place. Also, the reasons are inattentiveness of the pedestrian or driver. It is possible to reduce the probability of a traffic accident involving pedestrians by observing the basic rules, namely: the movement of pedestrians in specially designated areas; the use of retroreflective elements by pedestrians; pedestrians crossing the roadway in accordance with the rules; cross an unregulated intersection under safe conditions. Special attention should be paid to bad weather conditions. Visibility worsens, braking distance increases. In this regard, it is necessary to increase the vigilance of both pedestrians and drivers. Unregulated pedestrian crossings are the most dangerous. The type of pedestrian crosswalk is selected based on the intensity of traffic and pedestrian flows. However, a large number of factors affect the occurrence of conflict situations. To assess the level of compliance of a pedestrian crosswalk with traffic conditions, a pedestrian crosswalk hazard coefficient is entered that is equal to the ratio of the number of conflict situations based on traffic conditions to the maximum possible one. When calculating the number of conflict situations.

Keywords: *pedestrian traffic, accident rate, pedestrian crossing*

One of the main problems of traffic management in cities and localities is ensuring the safety of pedestrians. Road accidents involving pedestrians are one of the most important components of a high accident rate. According to various data published in the open press, for various regions of the country, accidents involving pedestrians account for up to 40%. Pedestrians and cyclists account for about 26% of all traffic deaths.

The most common type of accident in the Republic of Kazakhstan is hitting a pedestrian, which is 42.3% of the total number of accidents in 2018, while pedestrians account for 32% of the total number of deaths in accidents and 30% of victims. The consequences of accidents involving pedestrians are of great social significance as they are associated with death or injury [1].

In modern conditions of the city, due to the growth of the population and the number of cars, the problem of traffic safety is acute. Additionally it is caused by the following reasons:

- insufficiently developed road network, especially in the old, historical parts;
- sharply increased traffic intensity of transport and pedestrian flows, that use the same sections of the road network for traffic;
- the presence of a large number of routes for urban passenger transport;
- availability of Parking along the roadway.

The significant number of injured pedestrians in road accidents indicates that insufficient attention is paid to their safety. The complexity of the problem is that it is necessary to ensure the interaction of two streams: transport and pedestrian, which differ significantly from each other in their characteristics.

The main causes of injuries are related to the conditions of movement of pedestrians on roads and can be divided into three groups [2]:

- Related to traffic conditions.
- Related to pedestrian traffic conditions.
- Related to the psychophysiological characteristics of movement participants.

Traffic flow conditions are characterized by technical parameters of UDS, intensity, speed, composition and density. These parameters are random variables that are affected by a large number of factors, such as the width of the roadway and sidewalks, the equipment of the traffic control, the time of day and year, and the availability of infrastructure.

Pedestrian traffic conditions are determined by the quality of communication routes and are characterized by the width of pedestrian sidewalks, the presence of pedestrian crossings, as well as the equipment of sections of the control system.

Conditions related to the psychophysiological characteristics or subjective properties of road users which include factors related to the education, culture, and upbringing of road users. The subjective parameters of pedestrian traffic also include the age and gender of traffic participants, the purpose of pedestrian movement, the degree of compliance with traffic rules and the main disregard for traffic rules and their own safety, the desire of people to save effort and time.

The complexity of this task is due in particular to the fact that pedestrian behavior is more difficult to regulate than driver behavior, and it is difficult to take into account psychophysiological factors with all the deviations inherent in individual groups of pedestrians in the calculations of regulatory regimes.

Improper behavior of pedestrians is largely due to the most elementary indiscipline, disregard for the rules of the road.

A sociological study on the opinion of pedestrians shows that 72.4% of them deliberately commit offenses and only 27.6% - by negligence [2].



Figure 1-Frequency of traffic violations by pedestrians of various age groups

Data on the frequency of traffic violations by pedestrians is shown in figure 1. previously, all pedestrians Were divided into age groups: 18-24; 25-34; 35-44; 44-59; 60 or more years. The frequency of violations is represented by the following groups: every day, several times a week, several times a month, I do not violate traffic rules.

Data on violations indicate that the majority of pedestrians deliberately violate traffic laws. Moreover, in the age group of 18-24 years, violations of the first three types prevail. In group 45 and higher – the third and fourth groups.

By time of day, the largest number of accidents (about 50%) occurs in the period from 18 to 0 hours. This period is characterized by psychological fatigue of both drivers and pedestrians.

In the organization of road traffic, the following types of pedestrian traffic are distinguished[2]:

- pedestrian traffic on sidewalks;
- traffic on pedestrian crossings;
- movement within the pedestrian streets and routes (zones);

Pedestrian traffic on sidewalks and crosswalks is the most dangerous. The distribution of the number of accidents caused by pedestrians is shown in figure 2.

Pedestrian traffic on sidewalks is often accompanied by access to the roadway, which is a consequence of the discrepancy between the width of the sidewalks and the intensity of traffic and crossing in the wrong place. It can be assumed that the arrangement of pedestrian sidewalks of the required width and the use of pedestrian barriers, the prohibition of car Parking will significantly reduce this type of violation. It can be assumed that the use of prohibitive measures will direct pedestrian traffic to the authorized crossing of the roadway.

The distribution of traffic violations by pedestrians is shown in table 1 [2].

Table 1-Types of traffic violations by pedestrians

№	Types of traffic violations	%
1	Going to an unknown location	29,1
2	Walking along the roadway if there is a sidewalk	5,7
3	Crosswalk in front of a nearby vehicle	59,5
4	Unexpected exit due to transport, structures, trees	16,2
5	Crossing at a stop light	3,4
6	Drunken state	28,7
7	Other traffic violations	16,9

As follows from the data in table 1, such types of violations as crossing in the wrong place, in front of a nearby vehicle, or unexpectedly entering the roadway are mostly associated with crossing the roadway and are the most dangerous.

To organize pedestrian crossings, the following indicators are required: the traffic intensity for eight consecutive hours on a working day should be 600 units per hour or more (for motorways with a dividing strip – 1000 units per hour) on the main road in both directions; or 150 citizens per hour crossing the roadway for the same 8 hours. With the current degree of saturation of cities with vehicles, this means the need to organize pedestrian crossings at each intersection of the roadway and on street stretches [3].

Pedestrian crossings are divided by type of regulation into:

- * regulated (pedestrian traffic in a separate regulation phase);
- unregulated;
- * with partial regulation (pedestrians move together with turning vehicles, provided that this conflict is permissible).

Types of pedestrian crossings, conditions of use and equipment are shown in table 2

Arrangement of pedestrian ways of communication by technical means of traffic management (TMTM) should be performed in accordance with ST RK 1412-2010[3].

In accordance with [3], the following technical means are used to equip pedestrian crossings:

- road sign;
- marking;
- traffic lights;
- road fence;
- artificial irregularities;
- stationary outdoor lighting.

Table 2-Types of pedestrian crossings and equipment for road traffic management

Type of pedestrian crosswalk	Terms of use	Instruments TMTM	Disadvantages	Advantages
1	2	3	4	5
Adjustable	High intensity of pedestrian and traffic flows	Traffic lights with an additional section, road signs, markings	The decrease in throughput of the streets	High security

1	2	3	4	5
Unregulated	Insufficient intensity of pedestrian traffic, location near the objects of pedestrian traffic formation	Road signs and road markings, artificial obstacles	High accident rate	Low cost of equipment
With frequency regulation	The intensity of pedestrian flows in excess of 120 vehicles/h	Traffic lights, road signs, road markings	Reducing the throughput of turning streams	Less security

The main factors taken into account when placing pedestrian crosswalks are the intensity of traffic and pedestrians. However, a large number of factors remain unaccounted for, such as the width of the roadway and pedestrian crosswalk, the composition of the pedestrian flow, the generating capacity of adjacent objects, and the arrangement of the pedestrian crosswalk.

The presence of a large number of factors that are not taken into account when organizing pedestrian crossings and that undoubtedly affect safety requires an indicator that evaluates the quality of the pedestrian crossing by the safety criterion. Based on this, recommendations for optimal placement and arrangement of pedestrian crossings are justified.

The mechanism of an accident is the occurrence of a conflict in the "car-pedestrian-environment" system. The term "environment" refers to the degree to which pedestrian crossings are equipped with TMTM. A conflict is a situation in which pedestrians change their speed, i.e. they pass a vehicle that did not allow them to finish driving. Then the hazard coefficient (Ch) will be equal to:

$$K_{оп} = \frac{Y_{\phi}}{Y_{max}} = \frac{Y_{\phi}}{N_{tp} * N_{пеш}} \quad (1)$$

Where Y_{ϕ} – is the actual number of conflict situations per unit of time; Y_{max} – is the maximum theoretical number of conflict situations; N_{tp} – is the intensity of transport;

$N_{пеш}$ - pedestrian

Multiplicative power models are used to describe the actual number of conflict situations.

$$Y = \prod_{i=1}^n x_i^{\alpha} = x_1^{\alpha_1} * x_2^{\alpha_2} \dots x_n^{\alpha_k} \quad (2)$$

Where x factors that affect the probability of conflict situations: α indicator of the weight of this factor.

A priori ranking method was used to determine the list of factors affecting pedestrian safety. This method is used when processing data obtained from a survey of specialists or from research published in the literature. This experiment allows us to more correctly select factors for the subsequent experiment, justifiably excluding some of them from further consideration [4].

The results of the experiment are shown in table 3.

Table 3 - Results of the experiment are shown

Name of factors	Specific weight of factors	Name of factors	Specific weight of factors
The intensity of traffic flows	0,31	Average pedestrian speed	0,12
The intensity of pedestrian flows	0,20	Length of pedestrian crosswalk barriers	0,11
The width of the roadway	0,17	Other	0,09

Based on this data, the pedestrian crosswalk hazard coefficient will be determined in the future, which will serve as a basis for adjusting the type of pedestrian crosswalk, the degree of compliance with the actual conditions of the established means of traffic management, and determine the main parameters of pedestrian crossings.

REFERENCES

1. Site material <http://www.exclusive.kz/expertiza/daily/116903/>

2. Buga, P.G. Organization of pedestrian traffic in cities: textbook for universities / P.G. Buga, Y.D., Shelkov Y.D. – M.: Higher school, 1980. – 232 p.
3. ST RK 1412-2010 Technical means of traffic management. Rules for the use of road signs, markings, traffic lights, road barriers and guide devices. [Text] – Instead of ST RK 1412-2005; Introduced 22.11.2010г. – Astana, Committee of technical regulation and Metrology of the Ministry of industry and new technologies of the Republic of Kazakhstan. 2010. – 117p.
4. Kuznetsov, E.S. Management of technical operation of vehicles / E.S. Kuznetsov. - M.: Transport, - 1990. - 272 p.

ТҮЙІН

Жаяу жүргіншілер қозғалысын ұйымдастыру - өзекті мәселелердің бірі. Жаяу жүргіншілердің қатысуымен болатын жол-көлік оқиғаларының көп болуы, ең алдымен, жолдың қиылысында жолды пайдаланушылар арасында жанжал жағдайларының туындауымен байланысты. Жаяу жүргіншілердің қатысуымен болатын жол-көлік оқиғалары үлкен әлеуметтік маңызы бар, өйткені олар адамдардың қайтыс болуына немесе жарақаттануына байланысты. Жаяу жүргіншілер қозғалысын ұйымдастыру жол бойындағы тротуарларда немесе оның қиылысында жүзеге асырылуы мүмкін. Жаяу жүрудің соңғы түрі - бұл төтенше жағдай. Жолдың қиылысы әртүрлі типтегі және әртүрлі деңгейдегі жаяу жүргіншілер өткелдерінде, қозғалысты басқарудың техникалық құралдарымен жабдықталған. Ең қауіптісі - реттелмеген жаяу жүргіншілер өткелі. Жаяу жүргіншілер өткелінің түрі қозғалыс қарқыны мен жаяу жүргіншілер ағымының қарқындылығына сәйкес таңдалады. Алайда, қақтығыс жағдайларының пайда болуына көптеген факторлар әсер етеді. Жаяу жүргіншілер өткелінің қозғалыс жағдайына сәйкестігін бағалау үшін жаяу жүргіншілер өткелінің қауіптілік коэффициенті қозғалыс жағдайына негізделген жанжал жағдайларының санының мүмкін болатын максимумға қатынасына тең. Жанжал жағдайларының санын есептеу кезінде мультипликативті қуат модельдері пайдаланылады, мұнда факторлардың тізімі априорлық саралау әдісімен анықталады.

РЕЗЮМЕ

Организация пешеходного движения является одной из актуальнейших проблем. Большое число дорожно-транспортных происшествий с участием пешеходов вызваны первую очередь возникновением конфликтных ситуаций между участниками дорожного движения при пересечении проезжей части. Дорожно-транспортные происшествия с участием пешеходов имеют большое социальное значение, так как связаны с гибелью или травмированием людей. Организации движения пешеходов может осуществляться по тротуарам вдоль проезжей части или при её пересечении. Последний вид пешеходного движения является наиболее аварийным. Пересечение проезжей части осуществляется по пешеходным переходам различного вида и различной степени оснащения техническими средствами управления дорожного движения. Наиболее опасными являются нерегулируемые пешеходные переходы. Выбор вида пешеходного перехода производится по критерию интенсивности транспортного и пешеходного потоков. Однако на возникновение конфликтных ситуаций, влияет большое число факторов. Для оценки уровня соответствия пешеходного перехода условиям движения вводится коэффициент опасности пешеходного перехода равный отношению числа конфликтных ситуаций исходя из условий движения к максимально возможному. При расчете количества конфликтных ситуаций используются мультипликативные степенные модели, где перечень факторов определяется методом априорного ранжирования.

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Реметов Б.М., магистрант

Ибраев А.С., к.т.н. ст. преподаватель

Оверченко Г.И., к.т.н., доцент

НАО «Западно-Казахстанский аграрно-технический университет им. Жангир хана», г.Уральск

ИССЛЕДОВАНИЕ РАБОТОСПОСОБНОСТИ ВОДИТЕЛЕЙ АВТОБУСОВ

Аннотация

Интенсивный рост населения городов и количества транспортных средств выдвигает проблему повышения безопасности движения транспортных средств. Число дорожно-транспортных происшествий и их тяжесть непрерывно растет. Дорожно-транспортные происшествия примерно на