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**ORGANISATION OF VEHICULAR AND PEDESTRIAN TRAFFIC
THROUGH THE RAILWAY CROSSING****ОРГАНИЗАЦИЯ ДВИЖЕНИЯ АВТОМОБИЛЬНОГО ТРАНСПОРТА И
ПЕШЕХОДОВ ЧЕРЕЗ ЖЕЛЕЗНОДОРОЖНЫЙ ПЕРЕЕЗД****Kravchenya I.N. / Кравченя И.Н.***Ph.D. in Engineering Science., as.prof. / к.т.н., доц.*

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Abstract. *The article deals with the traffic indicators at the investigated railway crossing located at the intersection of Gagarina Street and Ukrainskaya Street in the city of Gomel (Belarus). The analysis of the current position of the traffic management scheme, the operation of the regulated facility, as well as the intensity of vehicles and the composition of the traffic flow was carried out.*

Keywords: *railway crossing, traffic management schemes.*

Introduction

The increasing concentration of road transport in cities, while maintaining the overall volume of the street and road network, creates problems for the functioning of traffic flows.

In many cases, railway crossings are bottlenecks, as they cannot cope with increasing traffic flows that severely limit the capacity of roads or streets in populated areas. The longest delays of vehicles and pedestrians occur at them, often resulting in long queues, congestion, etc. Congestion at railway crossings and increased traffic intensity through railway crossings leads to an increase in the number of road accidents in their locations, as well as worsens the environmental situation [1-2].

When justifying a traffic management option for vehicles and pedestrians on a particular section of the street and road network located in the railway crossing area, it is of practical interest to develop a methodology to predict traffic conditions there.

A theoretical description of road traffic situations occurring at an intersection of railways and roads at the same level using mathematical methods is not possible without prior formalisation [3-4].

Statement of basic materials

When considering the indicators of traffic on the object under study, we should highlight those that are the most important. These indicators include the analysis of the existing position of the traffic management scheme, the operation of the regulated object, as well as the intensity of traffic of vehicles and the composition of the traffic flow. The road network to be audited was the unregulated intersection at the junction of Ukrainskaya Street and Gagarin Street in Gomel city (Belarus), as well as the railway crossing located at this intersection (Figure 1).

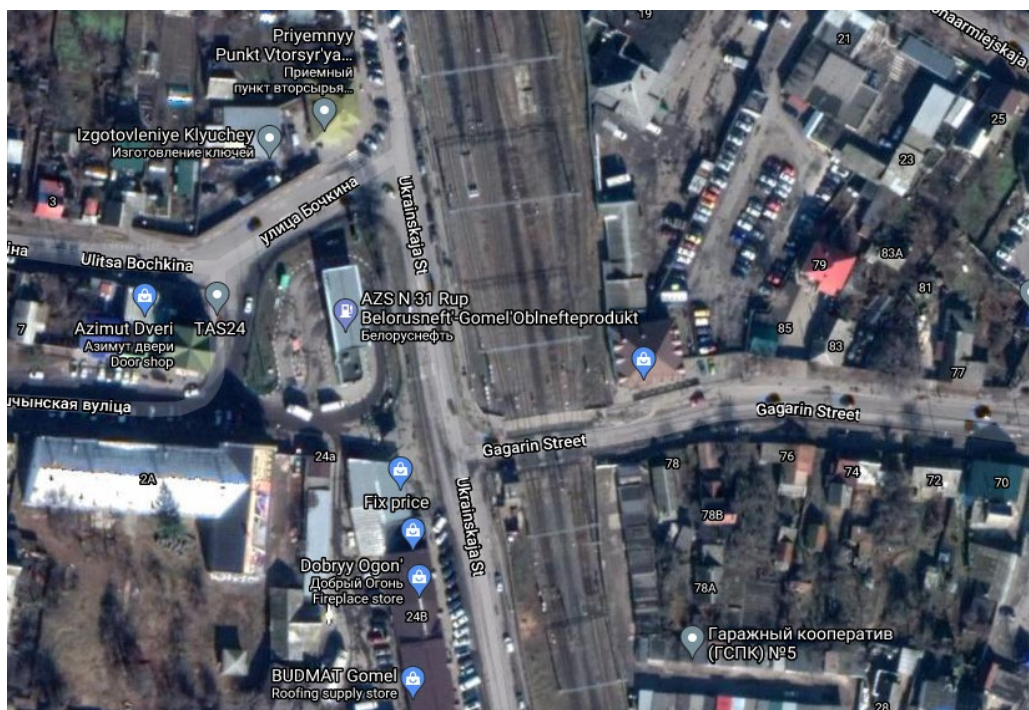


Figure – 1 The intersection at the junction of Ukrainkaya Street and Gagarin Street

The audit covered arrangement, condition, functionality of the railway crossing, conditions of visibility and traffic at the crossing, as well as organization of road traffic at the crossing.

The main road at the crossing changes its direction. According to TCP-45-3-03-227-2010 it has the road category 3 and accordingly has one carriageway - 1-2 lanes in each direction. The width of each lane is 3.5 m. Traffic flows prevail in the main direction and mainly consist of passenger vehicles. The condition of the pavement and pavements at the intersection is satisfactory. The street cannot be crossed by pedestrian crossing, the condition of pedestrian fencing on pavements is satisfactory, the roadway has small depressions in places, most depressions are patched, and the curbstone is damaged in some places. There are also lampposts, power lines and sewer manholes. Condition of technical means of traffic management is satisfactory, namely: road signs - good condition; road markings - missing or partially obliterated; traffic control devices work properly, no contamination; pedestrian barriers - in rare cases damaged. Lateral visibility in the "vehicle to vehicle" conflict is unsatisfactory. Objects reducing visibility are railway box, concrete fence which is almost not transparent, lampposts and supports of technical traffic control equipment, pedestrian fences. There is virtually no green space within the intersection; however, there are many objects of gravity for pedestrians (Figure 2).

During the observation period, an extensive number of traffic violations by both drivers and pedestrians were observed. The following violations by drivers were identified during the audit. Major traffic flows mainly on the main road, and it is difficult to join the queue of vehicles on the main road when the railway crossing is closed on the side of the secondary road. This increases the waiting time for turning. Consequently, vehicles on the secondary road start to break the rules. If the crossing is closed, there is a long queue on the main road (Figure 3).

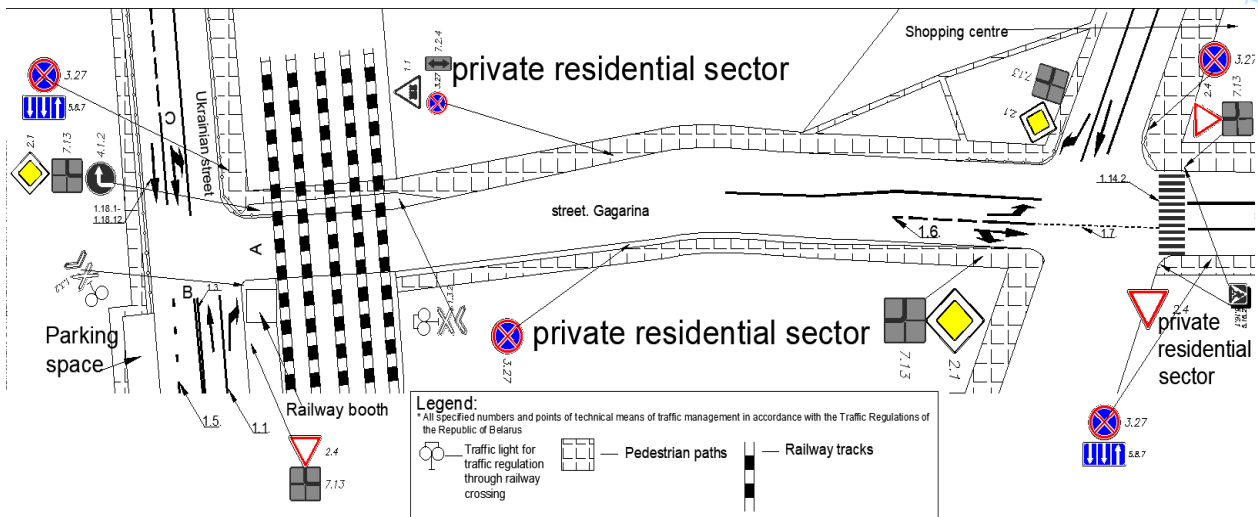


Figure – 2 The scheme of the investigated section of the road network



Figure – 3 Long queues at the railway crossing

Vehicles at the end of the queue begin to overtake or outrun, trying to take the leading position in the queue or to pass the railway crossing at the forbidden signal, thereby creating emergency situations for other drivers. With this aggressive driving style, they increase the accident rate and anger other drivers.

For the study data on traffic intensity and composition of traffic flow at the approach to the railway crossing were collected. A single survey of the reduced intensity of traffic arrival at the crossing was conducted for 20 minutes for each study period equal to 1 hour. The study periods were the morning and evening rush hours (7:00-10:00, 17:00-19:00) during the three-day observation period. Thus, measurements were taken 6 times. Traffic intensity and composition of traffic flow at the approach to the railway crossing is shown in Table 1.



A mathematical model of the movement of vehicles and pedestrians at the approach to the railway crossing Gagarina Street - Ukrainskaya Street can be presented as a queuing system and a simulation model has been created.

Table 1 - Traffic intensity and composition at the approach to the railway crossing Gagarina Street - Ukrainskaya Street

Date	Time	Traffic intensity and composition			
		N_1		N_2	
		passenger transport	cargo transport	passenger transport	cargo transport
07.11.2021	07:00-08:00	225	15	282	9
	08:00-09:00	195	9	303	9
	09:00-10:00	189	12	255	6
	16:00-17:00	603	9	540	15
	17:00-18:00	669	15	588	39
	18:00-19:00	594	12	519	12
08.11.2021	07:00-08:00	189	9	240	3
	08:00-09:00	207	12	288	6
	09:00-10:00	198	12	312	9
	16:00-17:00	576	15	585	18
	17:00-18:00	585	18	558	21
	18:00-19:00	603	21	594	18
09.11.2021	07:00-08:00	288	15	195	9
	08:00-09:00	225	18	201	12
	09:00-10:00	204	12	198	9
	16:00-17:00	534	27	405	12
	17:00-18:00	561	33	423	12
	18:00-19:00	612	24	582	15

Conclusions

Study of road and pedestrian traffic organisation and intensity across the railway crossing Gagarina Street - Ukrainskaya Street is the basis for developing a simulation model in GPSS World. The model simulation of vehicle and pedestrian traffic at the railway crossing will make it possible to analyse its work - to determine the downtime and queue length of vehicles and pedestrians in the railway crossing; to substantiate the choice of options to improve traffic conditions at the railway crossing



- the construction of additional traffic lanes, an overpass, traffic organization in Gomel. The obtained results can be implemented in the work of the Gomel branch of the Belarusian Railway.

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***Аннотация.** При обосновании варианта организации движения транспортных средств и пешеходов на конкретном участке улично-дорожной сети, расположенном в зоне железнодорожного переезда, практический интерес представляет разработка имитационной модели. Для разработки имитационной модели были рассмотрены показатели дорожного движения на исследуемом железнодорожном переезде, расположенном на пересечении улиц Гагарина и Украинской в городе Гомеле (республика Беларусь). Проведен анализ существующего положения схемы организации дорожного движения, работа регулируемого объекта, а также интенсивность движения транспортных средств и состав транспортного потока.*

***Keywords:** железнодорожный переезд, схемы организации дорожного движения.*

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