

In Ukraine, the practice of road safety audits is still emerging. However, experience from EU countries where such audits are mandatory shows clear benefits: lower crash rates, safer designs, and improved mobility. Therefore, audits should become a standard requirement for all road construction and reconstruction projects. Ultimately, road safety audits are not just a technical formality—they are a strategic tool for protecting lives, ensuring mobility, and creating a sustainable, user-friendly transport system.

References

1. Directive 2008/96/EC of the European Parliament and of the Council of 19 November 2008 on road infrastructure safety management.
2. European Commission Transport Portal — <https://ec.europa.eu/transport>
3. United Nations Economic Commission for Europe (UNECE) Road Safety — <https://unece.org/road-safety>
4. Transport Research Laboratory (UK) — <https://trl.co.uk>
5. Road Safety Audit UK Portal — <https://www.road-safety-audit.co.uk>
6. Federal Highway Administration (USA) — <https://www.fhwa.dot.gov>
7. Safe System Solutions — <https://safesystemsolutions.com.au>
8. International Transport Forum (OECD) — <https://www.itf-oecd.org/road-safety>
9. U.S. Department of Transportation — <https://www.transportation.gov/mission/safety>
10. World Health Organization (WHO) Road Safety — <https://www.who.int/roadsafety>
11. Ukrinform News Agency – Articles on road safety in Ukraine — <https://ukrinform.ua>
12. State Service of Ukraine for Transport Safety — <https://dsbt.gov.ua>
13. AvtoDriving — Ukrainian resource for road safety and traffic education — <https://avtodriving.com.ua>

DETERMINING THE DANGER LEVEL OF A COMPLEX CROSSROAD IN THE CITY

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Currently, there are several approaches to studying intersections, among which the most common are the office and field methods. Each of them has its advantages and disadvantages, depending on the tasks set and the resources available.

The desk-based method of intersection research involves analyzing data, statistics, and traffic modeling in an office setting, while the field method involves

direct observation of the traffic situation on site. The office approach is effective for preliminary assessment, but the field method is more effective because it allows for real-world conditions, such as driver and pedestrian behavior and unpredictable factors that are difficult to predict through modeling. Therefore, the study used the field method of “conflict situations,” which is an important tool for assessing road safety, especially when developing projects for the reconstruction of complex road sections. This method allows identifying potential danger zones on the road and helps in taking measures to eliminate or minimize risks. [1]

One of the main areas of research is the analysis of traffic flows. This allows the identification of areas where problems such as traffic jams or dangerous intersections may arise. [2] These intersections are points at the intersection of Heroiv Krut and Lesia Ukrainka streets in Kremenchuk, which are used in the conflict point method and are shown on the map in Figure 1.

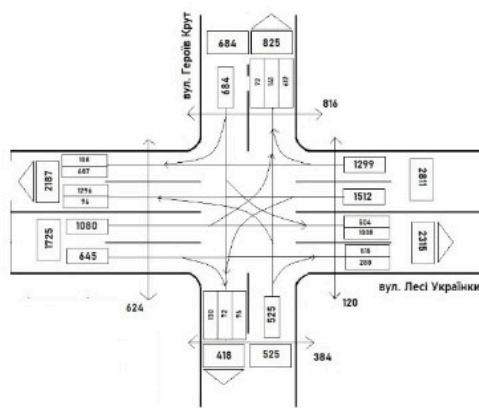


Fig. 1
Map of traffic flows and pedestrian flows

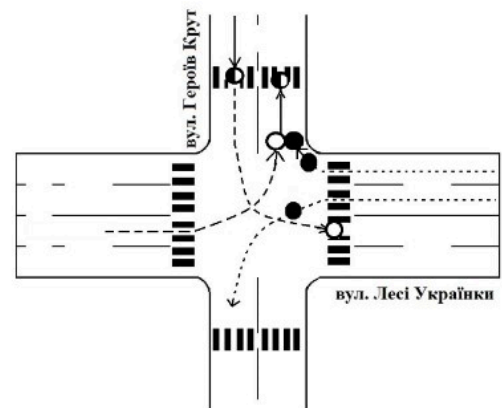


Fig. 2
Map of conflict flows and points at the intersection

where, ● — points of frequent conflict situations;

□ — points of moderate number of conflict situations;

● — points with a low number of conflict situations.

The level of traffic safety, the accident rate, at an intersection is:

$$K_0 = \frac{9,4053 \cdot 0,12 \cdot 10^7}{25 \cdot (5745)} = 7,8582 \quad (1.1)$$

Having obtained the value K_0 , we draw conclusions about the danger of an unregulated intersection: if $3 < K_0 < 8$ — the intersection is almost safe.

However, this method only provides us with theoretical information about the intersection, while the field method of “conflict situations” (MCS) is more effective and solves existing emergency situations at the intersection. In addition, the data from these methods are not always similar, so we use a field approach to research.

This method was used to study conflict points at intersections where the trajectories of different participants intersect or come dangerously close to each other, leading to conflict situations. Observations were made during peak traffic loads, which made it possible to collect data on situations of varying complexity — from mild to critical. The MCS assesses dangerous moments based on changes in driver behavior, such as speed and trajectory, which made it possible to create a detailed “danger map” of the intersection to predict the probability of accidents. The paper proposes an analysis of conflict situations at the above-mentioned intersection, which is an important transport hub.

During the observations, 24 conflict situations were recorded: 13 of them are classified as minor, 8 as moderate, and 3 as critical. As a result, 7 conflict points where these situations arose were identified. These points are shown in Fig. 2.

The number of conflict situations that led to critical situations can be determined by the following formula[1]:

$$K_{en} = 0,44 \cdot K_1 + 0,83 \cdot K_2 + K_3 \quad (1.2)$$

where K_1 is the number of minor conflict situations at the intersection in 1 hour;

K_2 is the number of moderate situations;

K_3 is the number of critical situations during the observation period of 1 hour.

Based on our observation data, we obtain the following value:

$$K_{en} = 0.44 \cdot 13 + 0.83 \cdot 8 + 3 = 15.36 \sim 16$$

This number of conflict situations is dangerous at the intersection. At the same time, the accident rate of the conflict point method is $K_0=8$, which corresponds to an almost safe intersection.

Thus, the field study proved the opposite. The data show that the intersection requires the development of additional safety measures. The conflict situation analysis method provides a more accurate picture because it takes into account real events — accidents, sudden maneuvers, violations — which gives it an advantage over desk-based methods that rely on secondary data. This method not only takes accidents into account, but also assesses potentially high-risk events, allowing dangerous areas to be predicted before incidents occur.

The advantages of the conflict situation method include risk prediction and efficiency, as it allows data on dangerous moments to be collected quickly, without waiting for statistics. Relevance and adaptability are also strengths of the method: it is sensitive to changes in road conditions and quickly identifies problems caused by new infrastructure or weather factors.

In addition, this method provides an understanding of the context of hazardous events, allowing the causes of conflicts, such as rule violations, road obstacles, and driver behavior, to be recorded. The disadvantage of the method is that it requires a long period of observation to obtain a complete picture and is sensitive to seasonal changes. Although the desk-based method is accurate due to the availability of project documentation, it can be useful for initial analysis, saving resources on field research, especially in difficult locations.

The analysis of conflict situations at the intersection identified the main problem areas and causes of dangerous situations. The conflict situation method made it possible not only to identify current threats but also to predict potential risks. The main problems include incorrect driver behavior, traffic light violations, ignoring traffic priorities, and insufficient attention to pedestrians at unregulated crossings.

As a result of this work, measures to improve safety can be proposed: improving traffic light control, recalculating the traffic light cycle or increasing the phases in time, installing additional road signs, or prohibiting dangerous maneuvers. These solutions

are aimed at reducing the number of conflict situations and increasing the overall level of traffic safety at the intersection. The recommended measures will affect the safety of other transport infrastructure facilities in the city, which in turn will help reduce the number of accidents. After the implementation of these measures, the intersection will require a repeat field study.

The field method of studying conflict situations has proven its effectiveness, allowing observation of real conditions and the behavior of traffic participants, which is difficult to predict using modeling. It helps to obtain relevant data on dangerous moments and quickly identify critical points for change. The desk-based method, based on statistical data and modeling, is useful for initial assessment but does not take into account all unpredictable factors, such as changes in driver behavior or weather conditions. Identifying real conflict situations that affect safety is a key advantage of the field method in such analysis.

Further analysis can also use methods such as audiovisual monitoring with video cameras to record situations at intersections, which allow for the analysis of vehicle movement over a certain period, as well as driver surveys, which allow for the collection of qualitative information about their behavior, attitudes toward traffic rules, and impressions of the safety of a particular intersection. This will make it possible to identify patterns of dangerous maneuvers and high-risk areas at intersections, which will significantly increase the effectiveness of measures to improve road safety.

References

1. Аудит безпеки дорожнього руху : підручник / Абрамова Л.С. та ін. Харків: ХНАДУ, 2015. 22с.
2. Chang, L. Traffic conflict technique for safety evaluation. - Elsevier, 2019.
3. Управління дорожнім рухом на регульованих перехрестях у містах: монографія / Форнальчик Є. Ю. та ін. Львів: Видавництво Львівської політехніки, 2018

MODELLING DELAYS AT UNREGULATED URBAN INTERSECTIONS, TAKING INTO ACCOUNT TRAFFIC AND INFRASTRUCTURE

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