Czech Traffic Conflicts Technique

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Abstract

The article deals mainly with defining the way of monitoring traffic conflicts. This issue is only one part of a greater safety analysis, or risk determination process of particular location. Based on the described procedures it is possible to apply the methodology also to more complicated nodes such as level crossings, sections town residential area or rural areas.

Keywords: traffic conflict technique, monitoring traffic conflicts, road safety analysis

1. Introduction

In most studies of road safety, analysts use the information contained by accident reports to identify and understand failures of the road system and then propose appropriate corrective actions. While these analyses are essential, it is well recognized that accident data suffer from a number of shortcomings and need to be complemented by field observations in order to improve the accuracy of safety diagnoses.

Monitoring of traffic conflicts compared to traffic accidents analysis is a less used method. Conflict situations are quite similar to accident situations, but are stave off in good time, such as by changing speed or direction. The advantage of this method is that by using it can detect problems before traffic accident occurs. While monitoring and evaluation of traffic accidents can take many years, the traffic conflict analysis takes some days or at most a month. Another advantage of the method of monitoring of traffic conflicts is its complexity – from the monitored locality can be in addition obtained the traffic-engineering data. Monitoring of traffic conflicts is not only more efficient (time-efficient, money-efficient), but primarily more humane because the safety problems can be solved before any traffic accidents with material damage, injury or death occur.

A well–accepted definition of traffic conflict is: 'an observable situation in which two or more road users approach each other in space and time to such an extent that there is a risk of collision if their movements remain unchanged'. (PIARC, 2003)

The project KONFLIKT (Methodology for the monitoring and evaluation of traffic conflicts in the Czech environment) has to create a practical tool for assessing and solving the road safety. The most promising approaches will be selected and these will be practically tested to verify their suitability for Czech conditions. The gained experiences will be used for creating the Czech methodology. It will be also created a special web application for training observers.

The starting point of the project is exploration of facts of previous research in the field of traffic conflicts. The main sources for the project are two American manuals 'Traffic Conflicts Techniques for Safety and Operations' – 'Engineer's Guide' (Parker & Zeeger, 1988) and 'Observers Manual' (Parker & Zeeger, 1989), the research of assoc. prof. Folprecht (Folprecht, 2000) and the Methodology for Monitoring Traffic Conflicts (Kocourek, 2010) developed on CTU by assoc. prof. Kocourek. This research builds primarily on the research of assoc. prof. Kocourek.

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2. Methods (PIARC, 2003 + Kocourek, 2010)

The research is focused on traffic conflicts as an alternative to accident data. Conflicts occur far more frequently in traffic and can include the whole range of incidences where the actual accident is just at one end of the scale. Techniques range from subjective to the more objective where conflicts are rated by measurements such as time to collision or post-encroachment time.

This research effort further enhances the usefulness of the traffic conflict technique as a tool to evaluate the safety of intersections. Traffic conflict technique enables to study hazards in traffic in an uncomplicated way.

For observing traffic conflict in practices is necessary to define four basic steps:

- Objective of traffic conflicts analysis;
- Conflict severity;
- Types of traffic conflicts;
- How to conduct a traffic conflict study.

2.1. Objective of traffic conflict analysis

A traffic conflict study can be used:

- To make progress in a safety diagnosis – Traffic conflict studies are particularly useful when accident data suffer from strong limitations (accident reports may be unavailable, the information may be insufficient or unreliable).
- To evaluate the effectiveness of a safety treatment – The main advantage of conflict studies over accident studies is that it is not necessary to wait several years before gathering sufficient data to complete the evaluation. A conflict study can be conducted soon after work has been completed and negative can be made quickly if anticipated benefits have not been achieved (or if unexpected side effects have been created).
- To compare the safety performance of different road features or traffic rules.

2.2. Conflict severity

For the traffic conflicts technique purposes three levels of conflicts have been defined. For the complex analysis of the studied locality even so-called level 0 and level 4 can be monitored. Thus there are five levels altogether (Fig. 1).

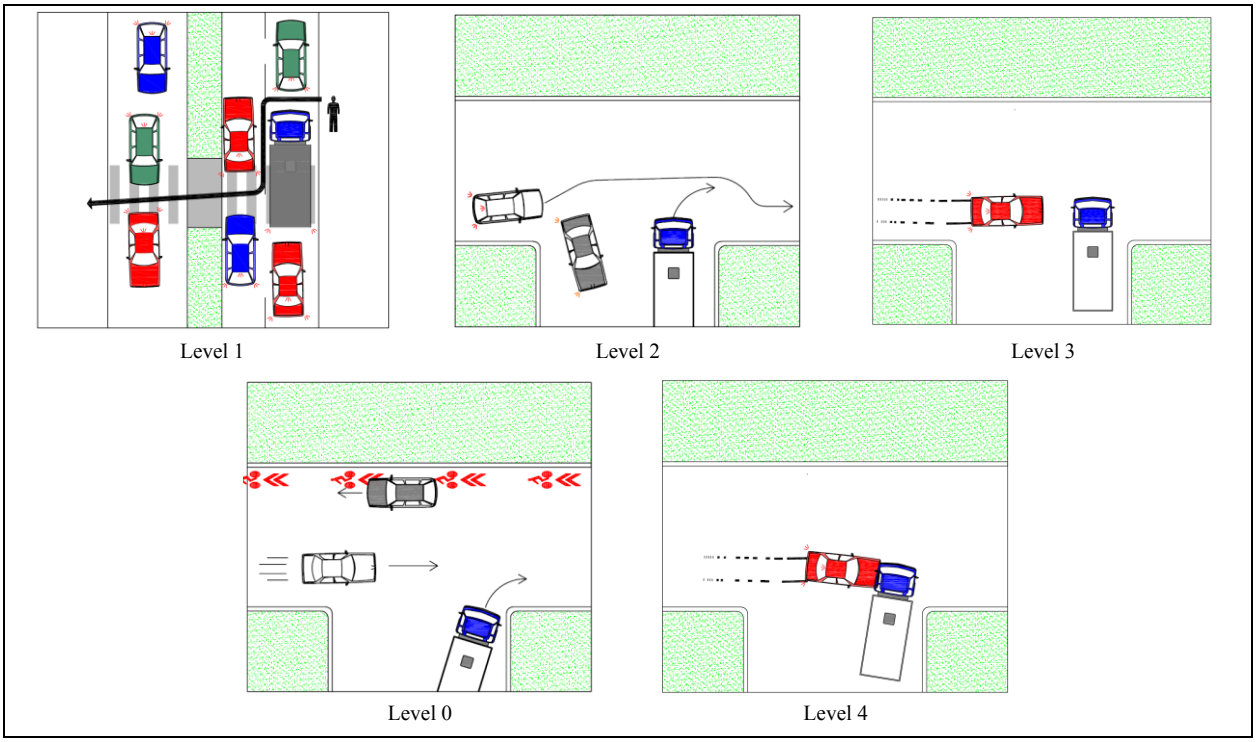


Fig. 1. Traffic conflict severity

The **level 0** is used for the record of mere breaking road traffic rules of the isolated vehicle (in the case of the roundabout this kind of maneuver was for example not to signalize stream compulsory direction change while leaving the roundabout).

The **level 1** is assigned to the controlled maneuver without any limitation or just with minor limitation. The example of this level is a conflict between a vehicle, which is standing on the pedestrian crossing, for example because of the traffic jam, and pedestrian, which would like to use this pedestrian crossing and has to go around the vehicle (see Fig. 1 – level 1). The difference between level 1 and level 2 is minor. In spite of that, it is necessary to realize that in some specific situations (the example with pedestrians) it is necessary to sort out this kind of conflict into less severe and more severe (**level 2**). According to the Czech law about traffic on the road the term 'not to be allowed to limit' is defined as the duty of the driver not to obstruct another participants of the traffic. The conflict **level 3** is assigned to such situations, when the road users are threatened and sharp maneuver (loud breaking supplemented for example with beeping) is necessary to avert traffic accident (according to the law about traffic on the road the term 'not to be allowed to endanger').

Level 4 is used for the case when a traffic accident occurs.

Example of traffic conflict record is below (Fig. 2).

Traffic conflict record Problem creator / Respondent – conflict severity Example: O / N – 1			
O	Personal vehicle	B	Bus
N	Cargo vehicle	T	Tramway car
NT	Long cargo vehicle	Ch / C	Pedestrian / Cyclist

Fig. 2. Traffic conflict record

2.3. Types of traffic conflicts

As in the case of accident analysis, it is quite useful to subdivide traffic conflicts into different categories, based on their type. This allows the preparation of summary tables, graphs and diagrams that facilitate the interpretation of results (comparisons with localities having similar characteristics and detection of deviant types of traffic conflicts). Our research defined 14 types of conflicts between two vehicles and one type of secondary conflicts.

However, some of these conflicts have very low rates of occurrences, which reduce their usefulness. The number of conflict types rises quickly when those that may occur between motorized and non-motorized road users are added to the list (pedestrians, cyclists, others). The list of conflict types that may be observed at a locality depends upon its prevailing traffic rules and geometric characteristics; this list should be determined prior to initiating the study. It is not necessary to observe all traffic conflicts that may occur at a locality in all conflict studies. If, for example, the objective is to compare the performance of two left-turn treatments at intersections, it might very well be sufficient to collect conflicts that are related to this maneuver.

2.4. How to conduct a traffic conflict study

A number of elements need to be considered in the planning of a traffic conflict study:

- Personnel training;
- Observation technique and period.

Personnel training

The validity and usefulness of a traffic conflict study are greatly influenced by the degree of consistency of observers. Two basic requirements must be satisfied the same observer must record conflicts consistently. Different observers must record the same conflicts consistently.

Within the project KONFLIKT is created the web application for training the observers. The program tests their perception of the severity and type of the traffic conflict. The trainees are watching several movies of traffic conflicts and they have to evaluate each watched traffic conflict. The movie cannot be stopped or replayed. The result is displayed at the end of the test.

Observation technique and period

The required number of observers (or the study duration when observations are made sequentially) depends on the number of conflict types to be observed, the average rate of occurrence for each conflict type, the traffic volumes, the number of intersection legs and the need for a traffic count.

The traffic conflict observation is usually conducted at daylight and in dry weather. In specific cases if traffic accidents occur at night or in wet it is recommended to conduct the observation in these conditions. The observation should not be conducted under unusual conditions such as road works, road accident etc. that disrupt a normal traffic behavior. If the road accident analysis shows the time dependence the traffic conflict observation should be planned for the time when the problems occur with the most probability.

Research is also focused on temporal variations of traffic conflicts in the traffic flow. The aim is to determine whether there are significant changes in the number and types of traffic conflicts observed in long-term monitored localities in terms of changes in annual and daily traffic variation.

3. Application (Kocourek, 2010)

Once observations have been completed, data must be reduced and summaries prepared. Results are presented either in summary tables or in traffic conflict diagram. Summary tables allow comparisons of conflict rates between the locality being analyzed and localities with similar characteristics, which is useful in detecting deviant patterns. The logic behind these analyses is similar to that of the accident pattern analysis. Traffic conflict diagrams are quite similar to the collision diagrams. They facilitate the identification of repetitive conflict patterns that are concentrated in some travel directions and intersection areas. For likelihood confrontation of traffic conflicts between separate junctions was chosen simple relative index of traffic conflicts k_R.

$$k_R = \frac{P_{ks}}{I} \cdot 100 \qquad (1)$$

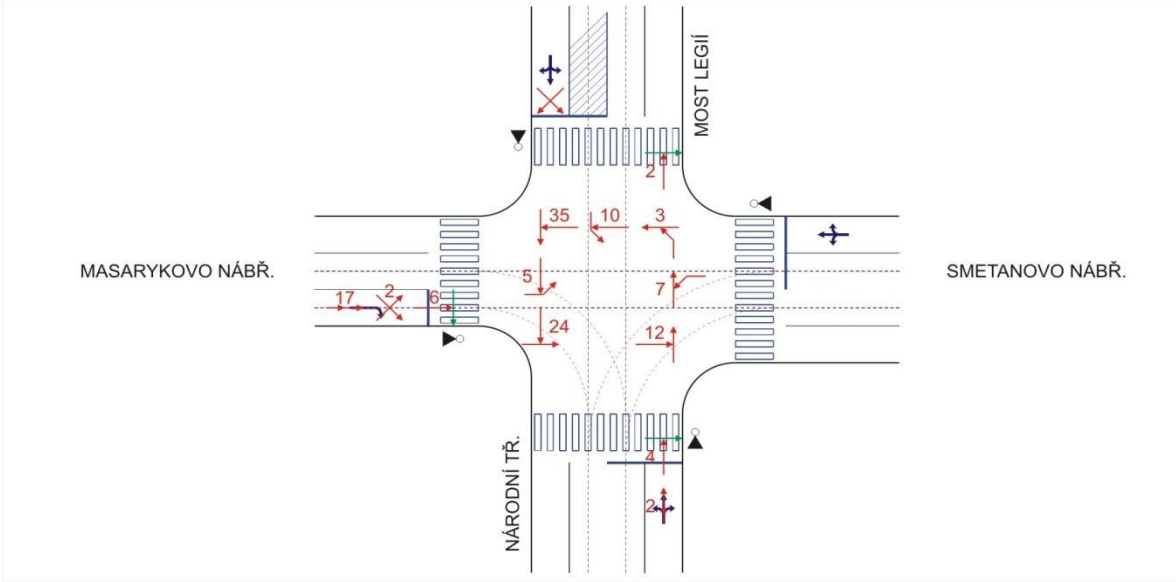
P_{ks} … conflict situations per hour (traffic conflicts of levels 1 – 3 only)
I … traffic intensity cv/h (converted vehicles per hour)

3.1. Year-on-year traffic conflict variation (KONFLIKT Project)

The survey was focused to detect annual changes in the stable traffic load intersection in the center of Prague at National Theatre (Národní × Smetanovo nábřeží). There was recorded year-on-year decline of traffic conflict rate, but the number and types of serious traffic conflicts remained comparable. See Figs. 3a and 3b.

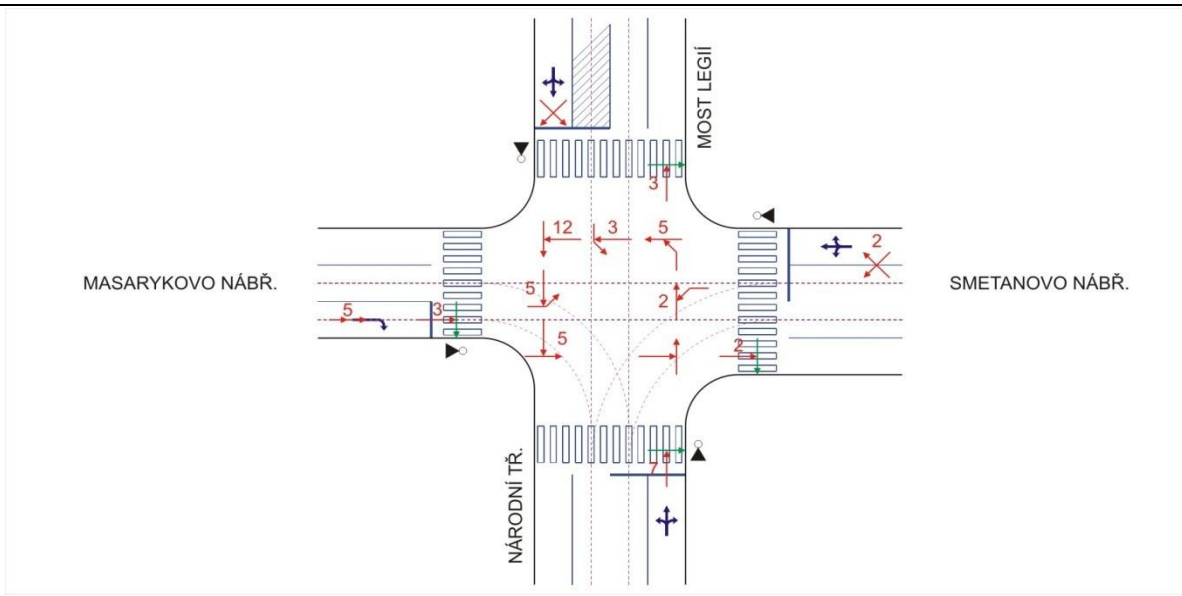
3.2. Daily traffic conflict variation (KONFLIKT Project)

The survey was focused to detect daily changes in the stable traffic load intersection in the center of Prague at Jirásek Square (Resslova × Rašínovo nábřeží). In the morning rush hour there were not recorded traffic conflicts within the inner area of the intersection, which is probably due to the high traffic intensity on the whole network and also the suitable signal plan. During the day the distribution of traffic conflicts was constant. See Figs. 4a, 4b and 4c.



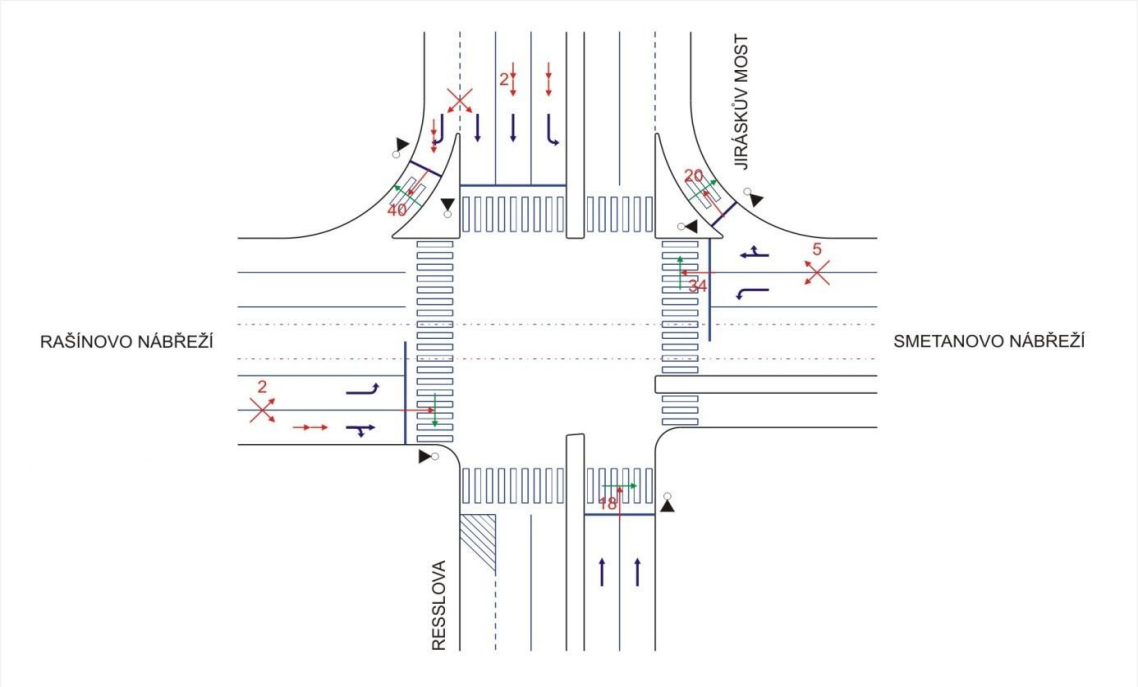
Traffic conflict situations				
Level 0	Level 1	Level 2	Level 3	Level 4
98	126	4	0	0
Relative conflict rate: $k_R = 7{,}82 = (130 \div 1663) \cdot 100$				

Fig. 3a. Traffic conflict diagram – Prague, National Theatre, 2011



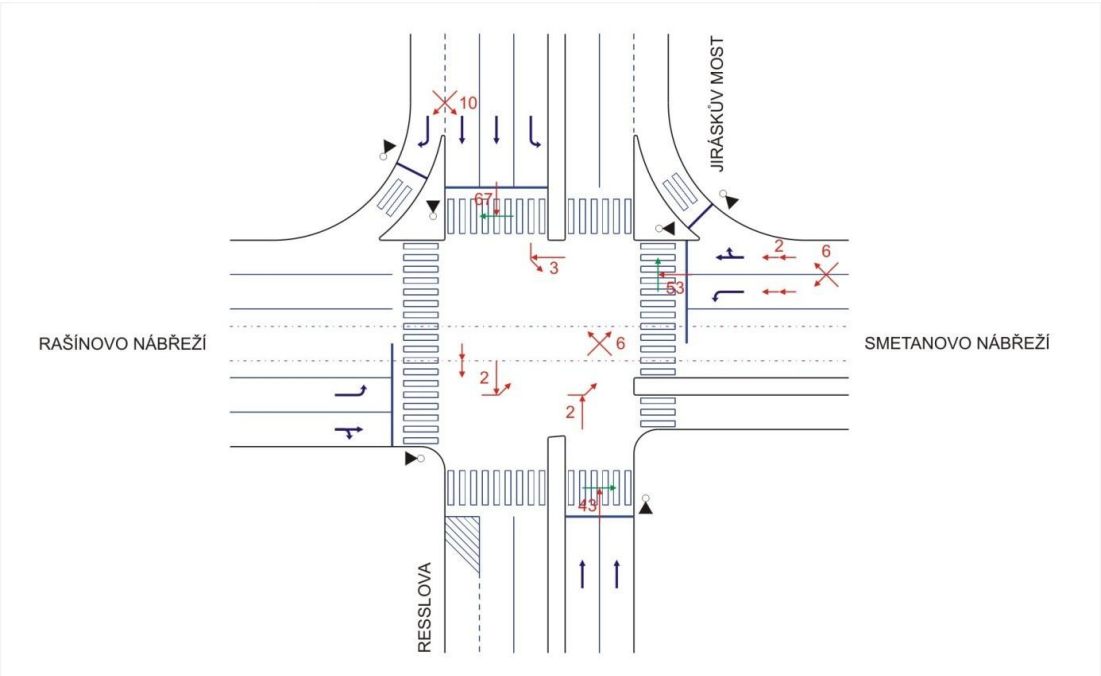
Traffic conflict situations				
Level 0	Level 1	Level 2	Level 3	Level 4
138	51	5	0	0
Relative conflict rate: $k_R = 3{,}70 = (56 \div 1513) \cdot 100$				

Fig. 3b. Traffic conflict diagram – Prague, National Theatre, 2012



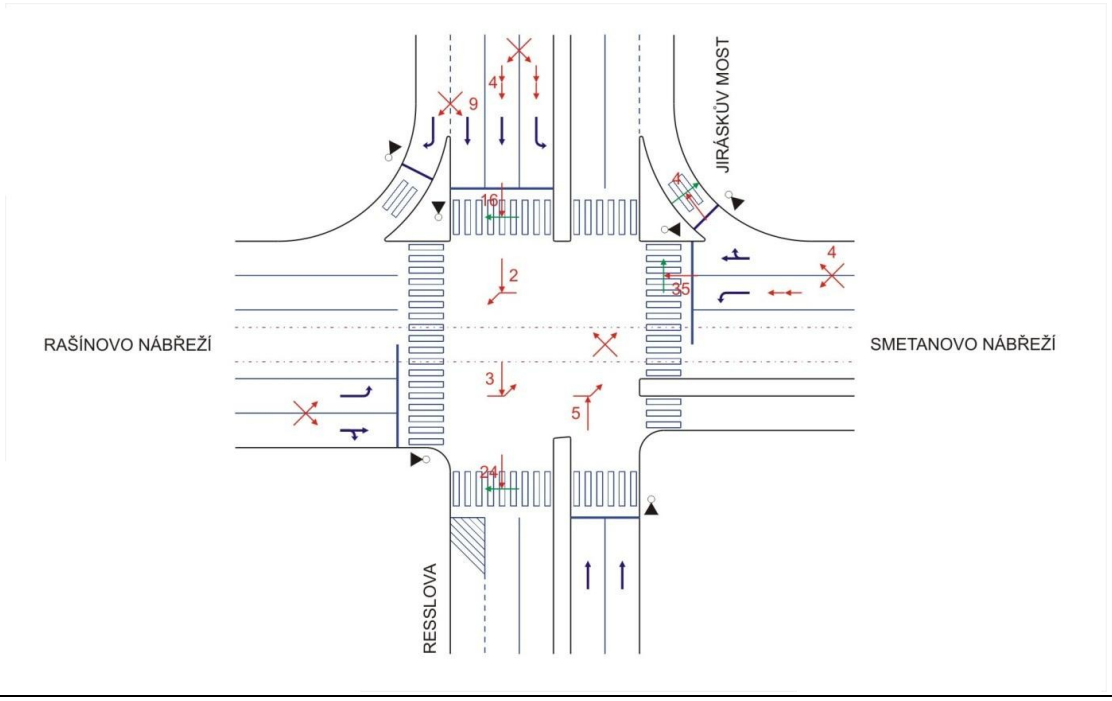
Traffic conflict situations				
Level 0	Level 1	Level 2	Level 3	Level 4
203	12	2	0	0

Fig. 4a. Traffic conflict diagram – Prague, Jirásek Square, 10th May 2012, morning rush hour



Traffic conflict situations				
Level 0	Level 1	Level 2	Level 3	Level 4
220	13	1	0	0

Fig. 4b. Traffic conflict diagram – Prague, Jirásek Square, 10th May 2012, midday traffic



Traffic conflict situations				
Level 0	Level 1	Level 2	Level 3	Level 4
275	11	3	0	0

Fig. 4c. Traffic conflict diagram – Prague, Jirásek Square, 10th May 2012, afternoon rush hour

4. Discussion and conclusion

This paper deals mainly with defining the way of monitoring traffic conflicts. This issue is only one part of a greater safety analysis, or risk determination process of particular location. Based on the described procedures it is possible to apply the methodology also to more complicated nodes such as level crossings, sections town residential area or rural areas.

Reliability of traffic conflicts records have to be ensured by thorough training of observers. Well-trained observers are actually the cornerstone for successful monitoring of traffic conflicts. Within the project KONFLIKT is developed a special web application pro observers training.

Another important part of the traffic survey is the appropriate choice of time to monitor the traffic conflicts. The partial conclusions of traffic surveys show that the number of traffic conflicts is in the long-term proportional to the traffic intensity and the types of traffic conflicts in a certain locality do not change influence of daily traffic variation.

In the next phase of project KONFLIKT will be monitored the selected problem localities with expected sufficient incidence of traffic conflicts. Selection of localities will not include only the intersections in urban areas, where the majority of traffic conflicts occur, but will take into account also pedestrian crossings, localities in rural areas and railroad crossings.

The main goal of the project is obtaining a sufficient amount of experience for developing the methodology for monitoring and evaluation of traffic conflicts that will be applicable in practice in the Czech environment.

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