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USING TRAFFIC CONFLICT METHOD IN EVALUATING TRAFFIC SAFETY AT THE RECONSTRUCTED INTERSECTION

ABSTRACT

As part of organised social system, traffic is subjected to general social tendency towards adequate safety and sustainability of relations in such a system, probabilistically marked by the risk of danger. Interpolation of subjective factor facilitates the occurrence of negative phenomena. Road traffic system is characterised by extremely massive participation in traffic, contributing thus to a greater possibility of negative features characteristic for imperfect human mechanism. This is precisely the reason why this paper deals with the problem of traffic safety on the concrete example of the intersection between the Savska Street and the Slavonska and Ljubljanska Avenues over the period of time prior to constructing the new underpass solution, and the period of time immediately after the construction works were completed. The used data have been provided by the Traffic Police Department - Lučko.

KEY WORDS

traffic accident, traffic conflict method, intersection

1. INTRODUCTION

General structure of risk results from situations marked by lower probability level of actual harmful consequences, and with increase in probability, the situation really occurs and it is known as *traffic accident*. Thus, the level of risk may be determined by registering the situation of certain probability of traffic accident, regarding their correlative relation by final results.

This method is called the *traffic conflict method*, studied in this paper. The essence lies in determining the level of risk by determining traffic conflicts and their relation to traffic accidents. The risk of objective situation is estimated according to the position and

movement of participants and the time possibility of collision with unchanged values.

After identifying the risk, one should analyse all the moments of traffic environment that may have contributed to the risk or helped its development. The identification of these objective circumstances would indicate the possibility of acting preventively within the traffic area, and by including and acting on the behaviour and traffic discipline of the participants reduce the level of risk, tending towards initial teleology in this segment of social activities.

2. GENERAL CHARACTERISTICS OF THE LOCATION

2.1 Features

The analysed intersection is the one between Savska Street - Slavonska Avenue - Ljubljanska Avenue, over the period from 1 January 1995 to November 1995, marking the start of reconstruction, and from 1 January 1997 to November of that same year.

In the meantime, or more precisely from November 1995 till November 1996 inclusively, the new underpass was constructed so that the intersection was given a completely new design.

2.2 Light signalling

Prior to the reconstruction and at present the intersection is equipped with light signalling devices - traffic lights.

3. RESULT OF TRAFFIC CONFLICT SITUATION

3.1 Collective state from January to November 1995 and 1997 according to types of accidents and errors made by participants

Types of accidents that occurred at the intersection and errors made by traffic participants causing traffic accidents were taken as comparison parameters both in 1995, prior to the reconstruction and in 1997 after the reconstruction.

Table 1 shows the share of every of the mentioned accidents and participants' errors, and their share in the total number of accidents at the given intersection (numerically and in percentage), whereas Figure 1 presents the share of every accident individually (all for the year 1995, which means before the reconstruction).

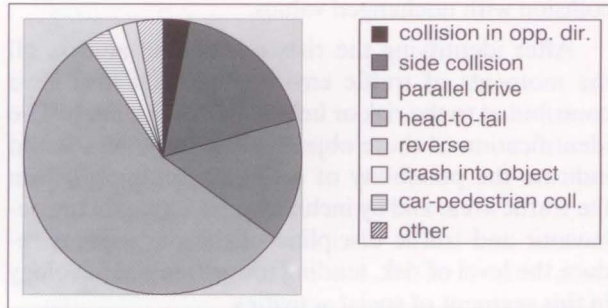


Figure 1 - Types of accidents at the Savska-Ljubljanska Av.-Slavonska Av. intersection in 1995

The mentioned period of time in 1995 registered 53 accidents, mostly head-to-tail collisions (29 - 54.8%), then side collisions (9 - 17.0%), parallel driving (8 - 15.1%) and collision of vehicles driving in opposite directions, reverse collisions, crashes into objects, car-pedestrian collisions, etc.

In case of participants' errors that contributed to traffic accidents according to the obtained data, most frequently the error consisted in tailgating at insufficient distance (14 - 22.2%), followed by improper switching of lanes (12 - 19.0%), and speeding not adjusted to road conditions (10 - 15.9%), failure to respect the traffic lights (8 - 12.7%), overspeeding (7 - 11.1%), improper turning, improper reverse driving, failure to yield the right of way, improper overtaking and other errors.

The following data indicate various accidents and participants' errors for the period in 1997, before the reconstruction of the intersection, in order to gain insight into some changes that have been achieved by the new construction design.

Figure 2 shows each one of the total number of traffic accidents.

The data obtained in 1997 show a total of 30 accidents, with the majority of accidents occurring while tailgating, in 16 cases or in 53.4%, followed by parallel driving (4 cases or 13.4%), crash of vehicles into an object on the road (in 3 cases or 10%), side collision (in 2 cases or 6.7%) and reverse driving, improper overtaking, skidding off the road, car-pedestrian collision and others for every accident one case each or 3.3%.

Table 1 - Overview of traffic accidents According To Types And Participants' Errors In 1995

Type of accident	Number	%	Participants' errors	Number	%
Collision of vehicles moving in opposite directions (01)	1	1.9	Overspeeding (01)	7	13.2
Side collision (02)	9	17.0	Speed not adjusted to conditions (02)	8	15.1
Parallel driving (03)	8	15.1	Tailgating at insufficient distance (03)	12	22.6
Driving in sequence (04)	29	54.8	Improper overtaking (05)	1	1.9
Reverse driving (05)	2	3.7	Improper turning (09)	1	1.9
Crash of vehicle into an object on the road (07)	1	1.9	Improper reverse driving (11)	2	3.7
Car-pedestrian collision (10)	1	1.9	Improper switching lanes (12)	10	18.9
Other (14)	2	3.7	Failure to yield right of way (13)	1	1.9
			Failure to respect the traffic lights (16)	7	13.2
			Other drivers' errors (19)	1	1.9
			Failure to use marked pedestrian crossing (22)	1	1.9
			Unexpected danger on the road (31)	1	1.9
			Sudden breakdown of a vital part in the vehicle (33)	1	1.9
Total	53	100	Total	53	100

Table 2: Traffic accidents according to types and participants' errors in 1997

Type of accident	Number	%	Participants' errors	Number	%
Collision of vehicles driving in opposite directions (01)	0	0.0	Overspeeding (01)	3	10.0
Side collision (02)	2	6.7	Speeding not adjusted to road conditions (02)	11	36.6
Parallel driving (03)	4	13.4	Tailgating at insufficient distance (03)	8	26.7
Platooning (04)	16	53.4	Improper turning (09)	2	6.7
Reverse driving (05)	1	3.3	Improper reverse driving (11)	1	3.3
Improper overtaking (06)	1	3.3	Improper switching of lanes (12)	2	6.7
Crash of vehicles into objects on the road (07)	3	10.0	Failure to respect traffic lights (16)	3	10.0
Skidding off the road (08)	1	3.3			
Car-pedestrian collision (10)	1	3.3			
Other (14)	1	3.3			
Total	30	100	Total	30	100

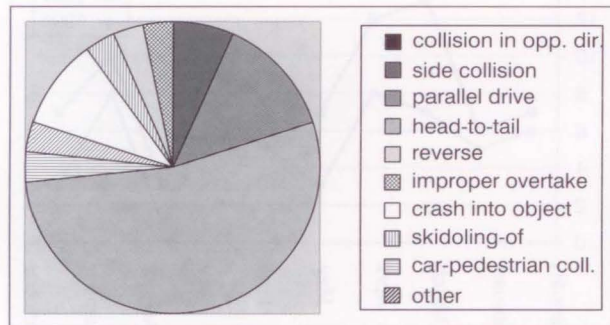


Figure 2 - Types of accidents at the Savska-Ljubljanska Av.-Slavonska Av. intersection in 1997

Regarding participants' errors, in the majority of cases (11), with 36.6% failure to adjust the speed to road conditions, followed by tailgating at insufficient distance in 8 cases (26.7%), failure to respect the traffic lights in 3 cases (10%), improper turning and improper switching of lanes - two cases each (6.7%) and improper reverse driving in one case (3.3%).

When comparing the data obtained for the same intersection prior to and following the reconstruction, there is little difference in data both regarding types of accidents and participants' errors

3.2 Structure of accidents per months, days, hours and condition of the roadway in 1995 and 1997

Comparing the data in these two years regarded through twelve months, it should be observed that in 1995 the majority of accidents happened in April and September, whereas in 1997 the majority of accidents happened in March. The condition in other months is more or less similar.

Table 3: Number of accidents per months in 1995 and 1997

	1995	%	1997	%
January	6	11.3	1	3.4
February	5	9.4	1	3.4
March	7	13.2	6	20
April	8	15.1	4	13.3
May	3	5.7	4	13.3
June	5	9.4	2	6.7
July	7	13.2	4	13.3
August	1	1.9	2	6.7
September	8	15.1	2	6.7
October	3	5.7	4	13.3
Total	53	100	30	100

Table 4: Number of accidents per days in 1995 and 1997

	1995	%	1997	%
Mon.	4	7.6	5	16.6
Tues.	6	11.3	4	13.3
Wed.	7	13.2	5	16.7
Thur.	7	13.2	5	16.7
Fri.	10	18.9	6	20
Sat.	13	24.5	5	16.7
Sun.	6	11.3	0	0
Total	53	100	30	100

Considering the data about accidents for these two years according to the weekdays, the majority of accidents in 1995 occurred on Saturdays, 13 cases (24.5%), followed by Fridays with 10 accidents, which could have been expected because of the weekend. In 1997 the situation was evenly distributed during the whole week except for Sunday with no accidents.

The above mentioned data are presented graphically and this shows that there is a different share of traffic conflict depending on the weekday. The greatest number of traffic conflicts occurs on Saturdays, which corresponds to the already known and expected data, since it is the weekend, when there is greater possibility of drunk driving and higher concentration of vehicles on the road.

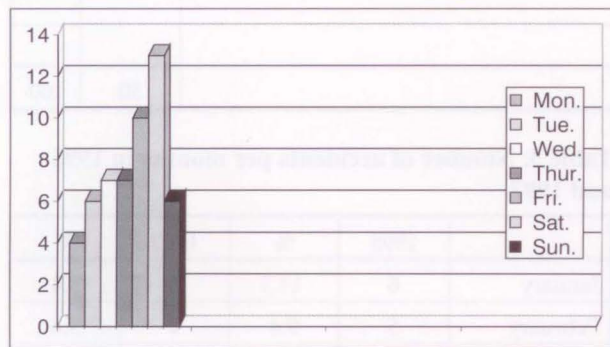


Figure 3 - Histogram of accidents per days in the week in 1995

Unlike data obtained for 1995, data for 1997 are somewhat different, since the majority of accidents occurred on Friday, whereas the number of traffic conflicts was almost evenly distributed over the other days of the week.

Comparing the known data for these two years, it is obvious that in the total number of traffic conflicts, this number is somewhat greater in 1995, which means prior to the reconstruction of the given intersection.

Comparing the data in the two years per months, it is obvious again that in the total number of traffic accidents, the number decreased in 1997, after the reconstruction, but this decrease has been far from substantial.

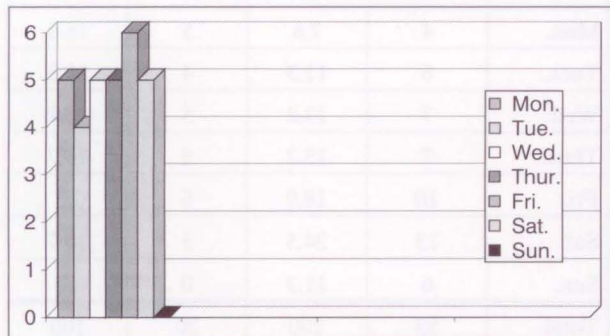


Figure 4 - Histogram of accidents per days in 1997

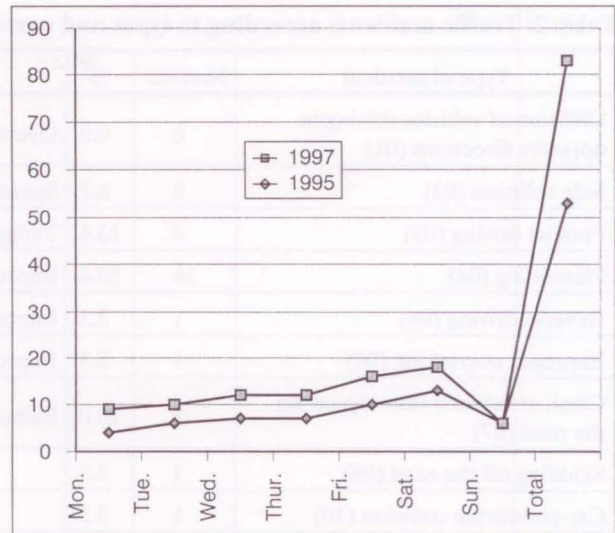


Figure 5 - Diagram of accidents per days in 1995 and 1997

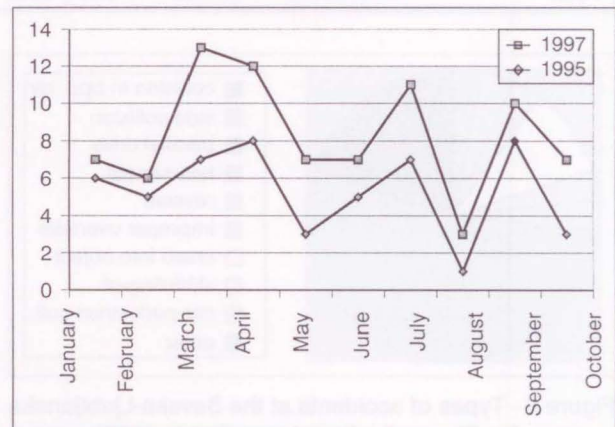


Figure 6 - Diagram of accidents per months in 1995 and 1997

Table 5: Number of accidents in 1995 and 1997 per hours

Time Interval	1995	%	1997	%
00-02	1	1.9	2	6.7
02-04	4	7.5	1	3.3
04-06	0	0	0	0
06-08	3	5.7	3	10.0
08-10	4	7.5	1	3.3
10-12	4	7.5	2	6.7
12-14	7	13.3	4	13.3
14-16	6	11.3	4	13.3
16-18	2	3.8	1	3.3
18-20	10	18.9	5	16.7
20-22	6	11.3	2	6.7
22-24	6	11.3	5	16.7
Total.	53	100	30	100

The mentioned data refer to the very time of accidents in 1995 and 1997. In 1995 the majority of accidents occurred between 6 p.m. and 8 p.m. - in 10 cases (18.9%). In 1997 the accidents were distributed over the whole day almost evenly, but still the majority occurred between 6 p.m. and 8 p.m. (5 accidents - 16.7%), which means the majority during the same period of time as in 1995.

The next feature in comparing these two years is the roadway condition at time of accidents. The table shows that the roadway was mainly, i.e. in the majority of cases dry and clean both in 1995 and in 1997.

Table 6: Roadway condition in accidents in 1995 and 1997

	1995	%	1997	%
Dry-clean (01)	48	90.6	26	86.7
Dry-sand, gravel (02)	0	0	0	0
Wet (03)	5	9.4	3	10.0
Mud (04)	0	0	0	0
Snow-cleaned (05)	0	0	1	3.3
Snow - not cleaned (06)	0	0	0	0
Total	53	100	30	100

4. CONCLUSION

Considering the data for the Savska Street – Slavenska Avenue – Ljubljanska Avenue intersection over a period of time in 1995 and in 1997, or more precisely prior to and following the reconstruction of the intersection, the aim was to see whether any advantages were gained by the new intersection design, i.e. whether the number of accidents occurring at certain intersection points was reduced.

The analysis of the obtained data for the given intersection allowed comparison of the data in the two years regarding various features such as: types of accidents, drivers' errors, roadway condition, number of accidents per days, hours and others.

The obtained data do not show great differences so that it may be concluded that not much has been achieved by the new construction design, and that the critical points where accidents used to occur have not been solved.

By monitoring the same intersection, and the events occurring there, data have been obtained about the number of severe accidents in the lower part of the intersection, i.e. in the underpass.

The collected data lead to the conclusion that not only has the situation regarding accidents in the very intersection not been solved, but the new, lower part

of the intersection has become dangerous and critical, in more than one way. One of the problems is the overspeeding of traffic participants, then insufficient lighting in the very underpass which is rather poor, not taking into consideration the time required by the eyes of the driver entering the underpass to adjust to the underpass lighting. These disadvantages of the underpass should be dealt with in order to increase traffic safety in the mentioned section of the road.

The carried out analysis of traffic safety at the concrete intersection prior to and following the reconstruction has obviously and evidently shown that solving the problem of traffic safety at a certain critical point is a complex problem which requires professional multidisciplinary approach so as to find the optimal solution. Otherwise, relatively high material means spent for the reconstruction of a certain critical point will not result in the expected and desired condition of traffic safety at that same point.

SAŽETAK

UPOTREBA TEHNIKE PROMETNOG KONFLIKTA ZA OCJENU STANJA SIGURNOSTI PROMETA REKONSTRUIRANOG KRIŽANJA

Promet kao dio organiziranog društvenog sustava potpada pod djelovanje općedruštvene težnje adekvatne sigurnosti i opstojnosti odnosa u takvom sustavu, probabilistično obilježeno nastupanjem opasnosti. Interpoliranost subjektivnog faktora pogoduje nastanku negativnih pojava. Cestovni prometni sustav karakterizira iznimna masovnost sudjelovanja u prometu, i samim tim veća je mogućnost manifestiranja negativnosti svojstvenih nesavršenome ljudskom mehanizmu. Upravo se iz toga razloga ovaj članak bavi problematikom sigurnosti u vožnji na konkretnom primjeru križanja Savske ulice, Slavenske i Ljubljanske Avenije u vremenskom periodu prije novog građevinskog rješenja u vidu podvožnjaka, te vremenu neposredno nakon završenih građevinskih radova. Korišteni podaci dobiveni su od Odjela prometne policije - Lučko.

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