Analysis of the cars lane changes accidents

Nicolae Ispas¹, Mircea Năstăsoiu²

¹Transilvania University of Brașov, inicu@unitbv.ro, Romania
²Transilvania University of Brașov, m.nastasoiu@unitbv.ro, Romania

Abstract. Experimental cars crashes test are valuable tools for improve overall automotive safety. Lane change crashes (or more properly, the lane change family of crashes) are defined in this paper, in according with generally accepted sense when a car collides with a vehicle running on a neighboring band when the first leaves its lane. Such collision results from various vehicle maneuvers including typical lane change or others. For present paper, the main aim is to quantify the post lane changes collisions parameters for endorsed influences over possible more dangerous traffic accidents occurring. Other goal of the paper was the study of speeds differences over changes in cars initials trajectories.

1 Introduction

Lane change collisions occur when driving on motorways or on urban and/or interurban roads with two or more lanes on the same direction. Accidents of this type can have the more serious consequences as speed differences (relative speeds) between cars involved and impact angles are greater. Often collisions in the lane change occur when lane change the car traveling on the neighboring lane is in blind spot mirrors.


Four crash experiments were made for determination of velocities, accelerations and rotation of the cars involved in lane changes collisions using crashes design showed in the fig 1 to fig. 4.

The main technical data of the cars used in the crashes experiments together with the cars shapes are presented in the same fig. 1 to fig.4.

Knowing that the cars weight and cars dimensions influences over post collision consequences we are uses motor vehicle with mass and dimensions “compatible” to avoidance. is inversely proportional to car mass or mass difference: in respect of Jan van der Sluis [4] “the heavier the car the lower the fatality or injury risk (and the higher the aggressiveness). Some authors also described the fact that in collisions between cars of equal mass, the outcome was better for heavier than for lighter cars”.

Fig. 1. First collision and cars involved characteristics in according with occurring tests
Despite low difference in cars speed, in all collision cases the collision angle in near in blind spot mirrors.

In all four experimental tests, human cars drivers were uses.

2 Experimental results and discussions

Four crash tests were performed according with EN1317 and EN12767. In each of them were use human’s car drivers in both in crash cars. Complex accelerometers were mounted in the Center of Gravity (CG) of each cars.

For quantify the influences over the cars after lane change collision, we used valuable data obtained from real world experimental crashes.

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All attempts have been made so that the speeds of the vehicles involved can be considered relative, and the experimental research scenarios, in all four cases, can be assimilated to accidents on the highway when changing the lane.

Assimilating the collisions of the four cases with those produced on the highway when changing the lane, it can be considered that the speeds of the cars involved are ordered in increasing order, starting from the cars that run on the first right lane.

This kind of test data enable the possibilities to analyze influences of collisions caused by lane changes on subsequent, often more dramatic accidents.
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In all four experimental tests, human cars drivers were used.

Fig.2. Second collision test and cars involved specifications.

Fig.3. Third collision test and cars involved parameters.

Fig.4. The fourth collision test and cars involved characteristics.

2 Experimental results and discussions

Four crash tests were performed according with EN1317 and EN12767. In each of them were use human’s car drivers in both in crash cars. Complex accelerometers were mounted in the Center of Gravity (CG) of each cars. Velocities, speeds (by GPS), accelerations and rotation of the cars were also measured.

For quantify the influences over the cars after lane change collision, we used valuable data obtained from real world experimental crashes.

All attempts have been made so that the speeds of the vehicles involved can be considered relative, and the experimental research scenarios, in all four cases, can be assimilated to accidents on the highway when changing the lane.

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In the fig. 5 shows the coordinate system of the vehicle in relation to which the velocities, accelerations and angles of rotation have been determined in all four test cases.

Fig. 6 to 17 show the variations in the velocities, speeds, accelerations and rotation angles of the cars involved in the four cases of lane-change collisions described in the previous chapter.

Corresponding author: inicu@unitbv.ro
Fig. 10. Accelerations of the cars involved in the second collision test.

Fig. 11. Rotation angles of the cars involved in the second collision test.

Fig. 12. Velocities and GPS speeds of the cars involved in the third collision test.

Fig. 13. Accelerations of the cars involved in the third collision test.

Corresponding author: inicu@unitbv.ro
3 Conclusions

The novelty of the paper are the comparisons of data set from two cars involved in each of four experimental crashes. Another novelty consists in possibilities to analyze the influences of the crashes parameter over both...
The data obtained are highly reliable given by the quality of the equipment used (N. Ispas, M. Năstăsoiu [5]).

Using for each lane change collision case the experimental obtained data, we can write the followers main conclusions:

**3.1 First crash test:**

1. Cars crash was at low collision relative speed (5.9 km/h);
2. In the hypothesis of the relative speed between the two cars and the similarity with highway traffic, the collision was caused by the car running on the higher speed lane;
3. For the P01 (the impactor car), a maximum acceleration of 23 m/s² is recorded in the Y (transverse) direction, and for the other car the maximum acceleration value is -12 m/s² recorded along the X axis (longitudinal);
4. The maximum rotation angle for the P01 was -11 degrees around the Z axis and for the P02 the maximum angle was -8 degrees around the same Z axis.

**3.2 Second crash test:**

1. Cars crash was at collision relative speed (11.4 km/h);
2. In the hypothesis of the relative speed between the two cars and the similarity with highway traffic, the collision was caused by the car running on the lower speed lane;
3. For the P01 (the impactor car), a maximum acceleration of -17.5 m/s² is recorded in the X axis (longitudinal) and for the other car the maximum acceleration value is -32 m/s² recorded along the Z axis;
4. The maximum rotation angle for the P01 was -9 degrees around the Z axis and for the P02 the maximum angle was -5.5 degrees around the same Z axis.

**3.3 Third crash test:**

1. Cars crash was at collision relative speed of 10.1 km/h;
2. In the hypothesis of the relative speed between the two cars and the similarity with highway traffic, the collision was caused by the car running on the higher speed lane;
3. For the P03 (the impactor car), a maximum acceleration of 16.5 m/s² is recorded in the Y (transverse) direction, and for the other car the maximum acceleration value is -8 m/s² recorded along the Y axis;
4. The maximum rotation angle for the P03 was -130 degrees around the Z axis and for the P02 the maximum angle was -15 degrees around the same Z axis.

**3.4 Fourth crash test:**

1. Cars crash was at low collision relative speed (1.2 km/h);
2. In the hypothesis of the relative speed between the two cars and the similarity with highway traffic, the collision was caused by the car running on the lower speed lane;
3. For the P03 (the impactor car), a maximum acceleration of -19 m/s² is recorded in the Z direction, and for the other car the maximum acceleration value is 55 m/s² recorded along the Y axis;
4. The maximum rotation angle for the P03 was -11.5 degrees around the Z axis and for the P04 the maximum angle was 4 degrees around the same Z axis.

**References**