Analysis of the dynamics of road accidents in Sibiu county, Romania, in the period 2010-2018

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Abstract. Sibiu county is located in the very center of Romania. The county, and especially its main city, Sibiu, is an important industrial and trade hub. Also, it is located at the crossroads of major roads heading towards the south, the east, the northeast, and the northwest. All these factors result in dense road traffic, which, combined with the conditions encountered on some of the roads, leads in turn to a relatively high number of road accidents. In the current paper, the authors analyze the evolution of the number of road accidents, but also its more severe consequences (fatalities and serious injuries) in Sibiu county from 2010 to 2018 and try to identify road safety measures that could help to limit these numbers. The accidents are analyzed from the type of road, but also from the time of their occurrence (day of the week and hour, respectively).

1. Introduction

Road safety is a very complex problem of modern society, involving several widely different categories of factors: human participants in the road traffic (car drivers, pedestrians, bicycle riders etc,), vehicles (trucks, cars, motorcycles, bicycles etc.), transportation infrastructure (roads, bridges, road signals etc.), controlling authorities (police), weather conditions, disturbances (road accidents, pollution) etc. Therefore, to have the best possible picture of the road safety situation, but also to be able to determine risks and to anticipate and counteract problems, it is necessary to have as much data as possible on all of these elements.

Road accidents are a significant source of social and economic problems and have to be recorded and analyzed in all their aspects to better understand them and work towards preventing them and minimizing their consequences. On the other hand, their economic implications mean that road accident have to be viewed as work accidents. Therefore road safety-related risks can be assessed using a methodology similar to that used for determining the risks at the workplace [1, 2].

Continuous innovation – be it in the area of renewable fuel sources [3, 4] or the area of road infrastructure improvements – can help to reduce the risk of road accidents. However, it is the active conscientization of this risk by all participants in the road traffic that can help most in reducing it.

At European level, the European Commission has tried to spur interest in road safety by setting, even starting with the year 2001, the ambitious goal of reducing in 10 years the number of road fatalities by 50%. While this target was not fully reached in 2010, the goal was renewed in 2011 for the next period of 10 years. In 2017 there had been recorded a reduction of the number of fatalities in road accidents by 20% compared to 2011 (from 31500 to 25260) [5, 6, 7].

The Romanian Government has adopted in 2016 the National Road Safety Strategy 2016-2020 [8], reaffirming the country's commitment to the reduction by 50% of the number of road deaths between 2010 and 2020, as well as several other measures meant to improve many elements related to the management of road safety [9, 10].

Since the number of road accidents is generally about the density of road traffic, road accidents are problematic, especially in counties containing roads with significant road traffic.

Sibiu county is crossed by several essential roads that usually see a high volume of road traffic. Therefore, road safety is critical in this area, and the analysis of the number of road accidents and of the conditions in which they occur is a significant step in applying the right road safety measures.

In the current paper, the authors analyze the number of accidents and the consequences of these accidents (fatalities, severe injuries or light injuries) produced in Sibiu county between 2010 and 2018 from several points of view.

2. Sibiu County and its road network

Sibiu county is an administrative division of Romania, located in the center of the country.
The main road transportation arteries of the county are (figure 1 [11]):

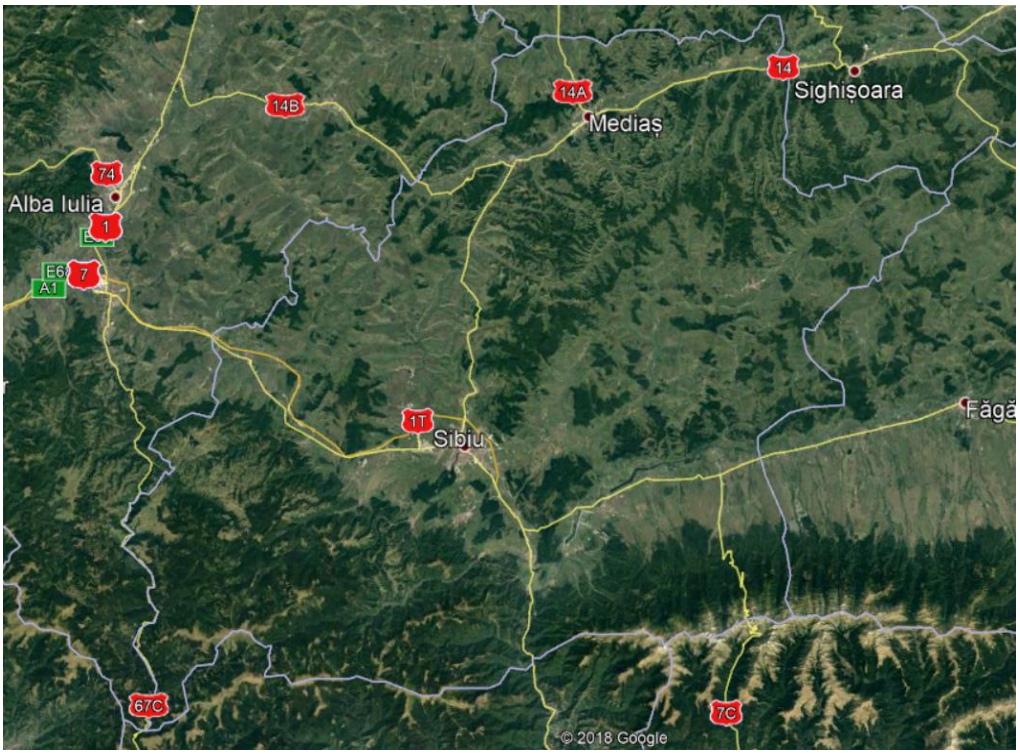


Figure 1. The main roads in Sibiu county [11].

- The national road DN1 Bucharest-Borș enters the county from the east, coming from Brașov, passes through the city of Sibiu and leaves the county in the west, towards Sebeș and Alba Iulia;
- The national road DN7 Bucharest-Nădlac enters the county from the south, through the Olt River Gorge, passes through the city of Sibiu and then leaves the county in the west, going towards Sebeș; from Sibiu to the border between Sibiu county and Alba county DN1 and DN7 share the same route;
- A segment of the A1 motorway starts from Sibiu and goes on towards the border between Sibiu county and Alba county, doubling the DN1/DN7 national road in that area.
- The national road DN14 links the city of Sibiu with the city of Mediaș and the city of Sghișoara (the latter located in Mureș county).

All of these roads are heavily traveled, so, despite efforts to improve the road infrastructure and the traffic controls, accidents happen regularly.

3. Analysis of the number of accidents and their consequences

The authors have analyzed the number of accidents produced in Sibiu county from January 1st, 2010 until December 31st, 2018 based on data from the National Car Accidents Registry and from the General Inspectorate of the Romanian Police [12, 13].

The analysis has revealed that in Sibiu county, the number of accidents has known an ascending trend, from 434 accidents in 2010 to 542 in 2018. The additional 108 accidents represent an increase of almost 25%, which is a rather steep increase. Of these, 196 (36%) were severe accidents, and 346 (64%) were light accidents.

Figure 2 presents the evolution of the number of serious car accidents and light car accidents, respectively, on the roads of Sibiu county, from 2010 to 2018.

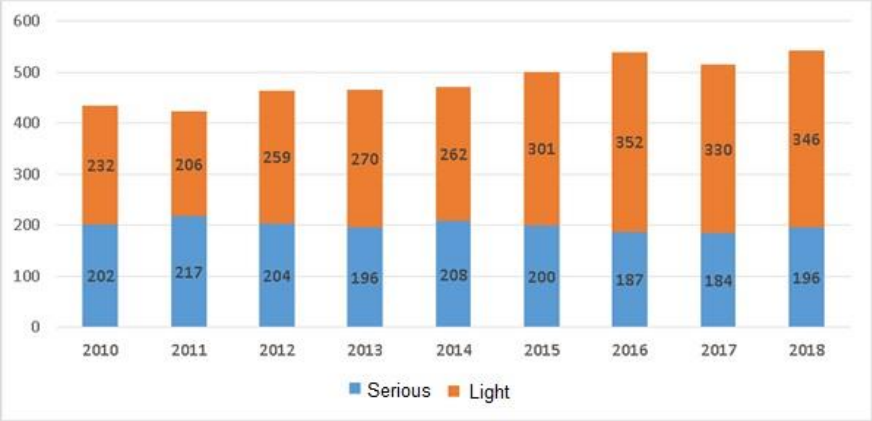


Figure 2. The evolution of the number of serious car accidents and light car accidents in Sibiu county from 2010 to 2018.

The consequences of the road accidents that occurred between 2010 and 2018 can be seen comparatively in figure 3.

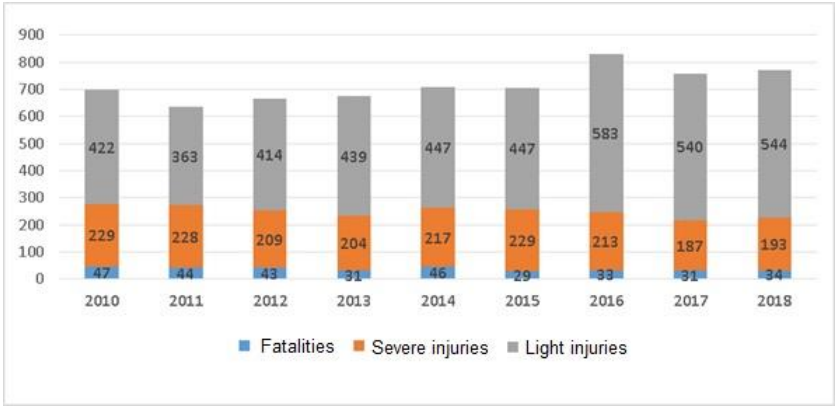


Figure 3. The evolution of the consequences of road accidents produced in Sibiu county from 2010 to 2018.

The road accidents produced in 2018 in Sibiu county resulted in the deaths of 34 persons (an increase by 3 compared to 2017 but a decrease by 13 compared to 2010), in severe injuries in 193 persons (again an increase of 6 compared to 2017 but a decrease by 36 compared to 2010) and in light injuries in 544 persons (an increase of 4 compared to 2017 and of 122 compared to 2010).

In this case, while there can be again noticed a generally ascending trend, there need to be emphasized the exceptions represented by the last two years, when the total number of accidents and the number of severe and light injuries has decreased compared to 2016. This can be attributed to the introduction, on two of the main road segments – DN1 from the border with Vâlcea county to Sibiu and DN7 from the border with Brașov county, at the end of 2016, of several measures for the increase of road safety and also to the opening of the A1 motorway segment from Sibiu to the border with Alba county.

Figure 4 presents the evolution of the number of accidents by road type. As can be seen, most accidents happened on the national roads, these being also the roads with the most substantial road traffic in the county. Also, 83% of all fatalities and severe injuries were recorded on national roads and streets within the limits of settlements.

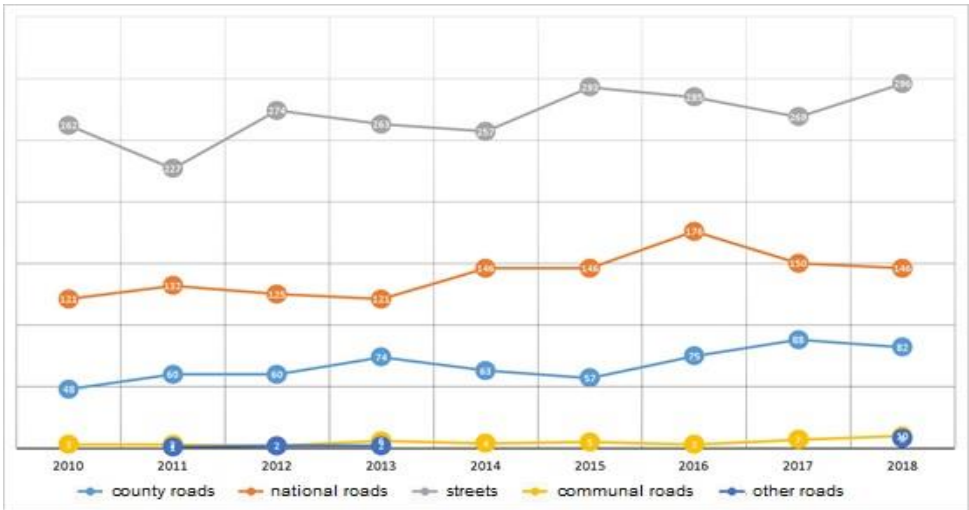


Figure 4. Evolution of the number of accidents by road type.

The distribution of road accidents in Sibiu county by the day of the week is indicated in figure 6.

It can be noticed that most accidents happened at the beginning of the weekend (Friday) but also at the beginning of the week (Monday and Tuesday). This is valid also for the city/village streets and the national roads, indicating an intensification of activity in the localities and a tendency towards traveling over longer distances on these days. On the other hand, Sundays see fewer accidents on the streets, but a peak of incidents on the county-level roads.

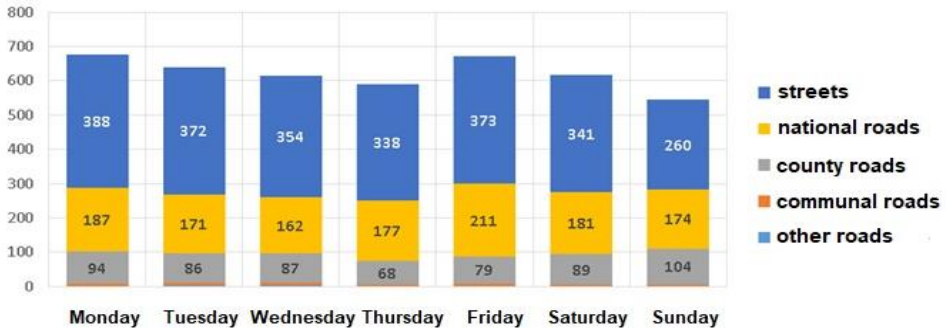
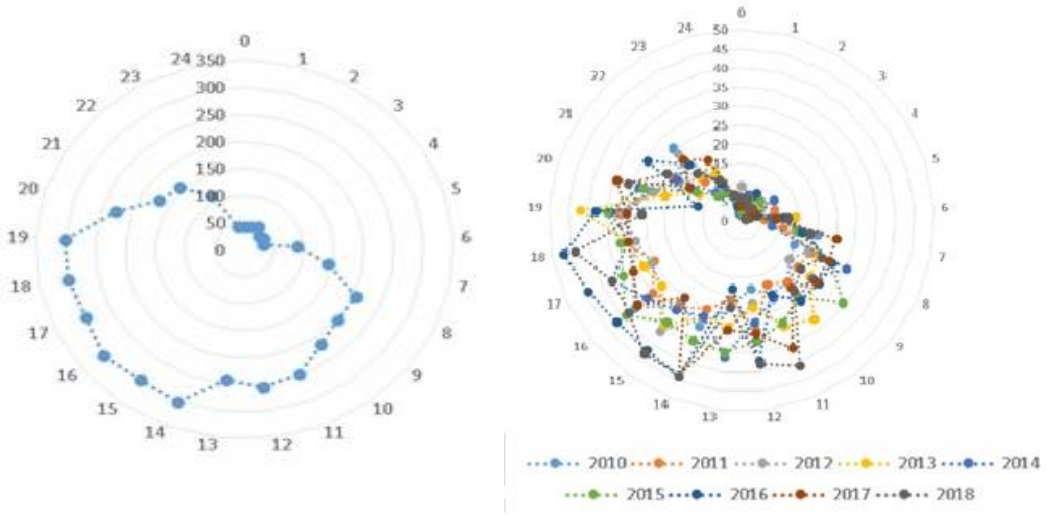


Figure 6. Distribution of road accidents in Sibiu county by the day of the week.

Figure 7 shows the hourly distribution of accidents in Sibiu county for the period from 2010 to 2018. As can be seen, most accidents produced in Sibiu county between 2010 and 2018 happened between 14:00 and 19:00. This can be explained by the end of the workday, by the tiredness of people after work but also by the eagerness of people to return home.



a) b)

Figure 7. The hourly distribution of road accidents in Sibiu county between 2010 and 2018: a) total number of accidents over the 9 years; b) number of accidents for each year

4. Conclusions

The current paper has analyzed the dynamics of the road accidents produced in Sibiu county between the years 2010 and 2018.

It can be concluded that the majority of accidents that occurred on the roads of Sibiu county in the period 2010-2018 had as a main favoring factor the human factor, which is the most important, but also the most difficult to manage.

This is especially significant when because 98% of the road accidents occurred on flat road segments and 77% of the road accidents occurred on dry roads.

In the future, the authors intend to expand their studies about road safety management to include a more in-depth analysis of the causes of road accidents and their correlation.

References

[1] Gligor A 2015 *Scientific Bulletin of the Petroleum-Gas University of Ploiesti, Technical Series*, **LXVI** 4 55-60
[2] Gligor A and Petrescu V 2018 *Matec Web Conf.* **184** 03005
[3] Dumitru M, Stanciu M, and Bibu M 2013 *Lucr. St. Manag. Agr*. **15** 156-159
[4] Bibu M and Dumitru M 2014 *Sci. Pap. Manag. Ec. Eng. Agri. Rural Dev.* **14** 35-38
[5] European Commission 2011 *Roadmap to a single European transport area – towards a competitive and resource efficient transport system* (Brussels: European Commission)
[6] ETSC 2018 *Ranking EU progress on road safety. 12th road safety performance index report* (Brussels: European Transport Safety Council)
[7] ERSO 2018 *Annual accident report 2018* (Brussels, European Commission)
[8] Government of Romania 2016 *National road safety strategy for the period 2016-2020* (Bucharest: Monitorul Oficial al Romaniei)
[9] Government of Romania 2012 *Law 265/2008 regarding the management of the safety of traffic on the road infrastructure, republished* (Bucharest: Monitorul Oficial al României)
[10] Government of Romania and AECOM 2015 *Final revised variant of the report on the master plan on short, medium and long term* (Bucharest: AECOM)
[11] Google 2018 *Map of Sibiu county* (Mountainview, California: Google)
[12] Inspectorate-General of the Romanian Police 2019 *EAC Registry of road accidents* (Bucharest: Romanian Police)
[13] Inspectorate-General of the Romanian Police 2019 *Statistics* (Bucharest: Romanian Police)