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Title

The Effect of Mobility Characteristics on Road Safety in European Cities

Authors

George Yannis, Professor, **Katerina Folla**, Research Assistant, **Dimitrios Giagkou**, Civil Engineer

Department of Transportation Planning and Engineering,
National Technical University of Athens

Abstract

Road accidents are one of the leading causes of death worldwide. According to the World Health Organization (WHO), more than 1,2 million are killed in road accidents worldwide annually, while road accidents constitutes the main cause of death for young people aged 15- 29 years old. The more and more increasing urbanisation and the rapid motorization in many cities of the world have led to an increase in road fatalities inside urban areas during the last years. In the EU, in 2017, more than 25.000 people were killed in road accidents, with 38% of the fatalities being occurred inside urban areas. The majority of urban road fatalities concern Vulnerable Road Users (pedestrians, cyclists, powered two-wheelers). The respective percentage of VRUs recorded in the EU urban roads was 70%, with 40% of them being pedestrians.

The objective of this research is to explore the effect of mobility characteristics on road safety in the European cities. On that purpose, data on mobility, demographics, economic indicators, as well as road fatalities and their characteristics were collected for 25 European cities. More specifically, data on the number of vehicles in traffic by type of vehicle, trips per mode transport, population and road network characteristics and the per capita Gross Domestic Product (GDP) for these cities were collected by the UITP Mobility in Cities Database (MCD) for 2012. Additionally, data on road fatalities and their distribution by type of transport mode and time of the day were collected from the EU CARE database with disaggregate data on road accidents. It should be noted that the collected data from the different sources were checked and selected in such a way in order to ensure that they refer to the same administrative divisions and are comparable.

Subsequently, a Generalized Linear Model was developed correlating the total number of fatalities with the GDP per capita, population density, road network density, the number of motorcycles in traffic per population, the public transport capacity and the number of trips by bicycle. Moreover, six additional Generalized Linear Models were applied, correlating the same independent variables with i) the fatalities during night-time, ii) the fatalities during daytime, iii) pedestrian fatalities, iv) car passenger fatalities, v) cyclist fatalities and vi) motorcyclist fatalities, while sensitivity analysis was also conducted in order to explore the different impact of mobility characteristics on various types of urban road fatalities in the EU.



The results revealed that an increase in public transport capacity offered and the number of cycle trips leads to a reduction in the number of fatalities in urban road accidents, while a positive relationship was identified between the number of motorcycles in traffic and the number of urban road fatalities. Moreover, it was found that the denser road network, the higher population density and the higher GDP per capita are associated with fewer road fatalities in the European cities. Additionally, it is worth mentioning that the number of cycle trips have greater impact on fatalities during daytime compared to the other types of fatalities examined, while the number of motorcycles in traffic have greater impact on fatalities during night-time and motorcyclist fatalities. Concluding, the results of the analysis allow for an overall assessment of the road safety level in the European cities, thus providing useful support to decision makers working for the improvement of safety in the European road network.

Innovative aspects

The current research introduces a cross-city analysis in order to estimate the relationship between the mobility characteristics and the number of fatalities in road accidents in different cities in Europe. For this reason, indicators related to modal split, vehicle fleet and road infrastructure were taken into account in the analysis. However, the examined cities have a different background, which would be essential to be taken into consideration. For this reason, demographic and economic indicators were also included in the analysis, in order to explore their combined effects alongside with the mobility characteristics on road safety performance. It was, therefore, attempted to develop macro-level models, which could be used in the planning and decision making process at a city level. Moreover, the effects of the above characteristics were explored not only on the total number of fatalities, but also on the different types of fatalities, aiming to identify the key risk factors for the different types of road users (pedestrians, cyclists, motorcyclists, passenger car occupants), as well as by time of the day (daytime, night-time), while a comparative analysis was also conducted.

Results achieved

The results of the analysis showed that the capacity offered by public transport plays a key role in the reduction of the road fatalities in the cities, since higher capacity offered is related to higher use of public transport and therefore, there is a lower possibility of occurring a road accident. Furthermore, cycling in cities was also found a critical factor contributing to the improvement of road safety level. The bicycle as an alternative option, can lead to a decrease of fatalities on urban roads, if adequate related infrastructure is provided. An increase in motorcycles' traffic is associated with an increase in the number of urban fatalities, since motorcyclists have a higher level of risk compared to passenger car occupants. Moreover, it was found that the population density and the road network density have a negative relationship with the number of fatalities, which may be explained by the lower traffic speeds and the higher congestion prevailing in cities. Finally, the GDP per capita was found to have the highest impact on the accident road fatalities, indicating that the better economic performance of the cities is linked to a better road safety culture and a h

Lessons learned

The current research showed that the road safety performance of the cities depends on many factors, which are not only related to transport, but also to the demographic and the economic situation of the cities. Additionally, the sensitivity analysis, conducted within this research, highlighted that the effects of these factors vary among the different types of road fatalities. More specifically, it is recommended that the essential measures in order to improve the road safety level of a city are the increase of the capacity offered by the public transport and the promotion of the bicycle as one of the main modes of transport for the daily trips of the citizens. Another measure in order to reduce the number of people killed on urban roads is the reduction of the motorcycles in traffic. For

this reason, there is a need not only to create a safer road environment in the cities, taking also into account the VRUs, but also to provide incentives to the citizens for the use of alternative means of transport. Concluding, the results of the current research shed more light on the key factors affecting the road safety performance of the European cities, aiming to provide useful support to decision makers.

