Use of infrastructure parameters from OSM data to assess cyclist safety in European cities

Camilo Cardona-Torres [a,*], Albine Chanove [b], Mathias Gröbe [a]

[a] Institute of Cartography, Technical University of Dresden,
camilo.cardona_torres@mailbox.tu-dresden.de, mathias.groebe@tu-dresden.de
[b] Fraunhofer Institute for Transportation and Infrastructure Systems, albine.chanove@ivi.fraunhofer.de

* Corresponding author

Keywords: cycling, OpenStreetMap, road infrastructure, road safety, Volunteered Geographic Information

Abstract:

Deaths and injuries resulting from traffic crashes are a serious problem around the planet. As a matter of fact, in 2016 1.35 million people died on the roads worldwide, which led to identify crashes as the 8th cause of death for people of all ages and the 1st cause of death for children and young adults between 5 and 29 years old (World Health Organization, 2018).

Since road infrastructure influences injury and crash risk (Reynolds et al., 2009), it should be considered in road safety assessments. Although official traffic authorities gather information regarding road infrastructure, they typically do it for specific operational and maintenance needs, and this information is rather difficult to get (Collins & Graham, 2019). Giving these facts, it is necessary to explore other sources that bring information to enhance road safety assessments based on infrastructure parameters. For this task, OpenStreetMap (OSM) plays a significant role as a Volunteered Geographic Information (VGI) tool, since the crowdsourced data is open and its processing can be replicable around the world (Jokar Arsanjani et al., 2015).

Motivated by the consequences of traffic crashes, the potential of cycling and the availability of VGI data, the overarching goal of this research is to assess cyclist safety including official crash data and infrastructure parameters at intersections gathered from OSM in three cities from Germany, France and Great Britain. In this way, the road safety assessment will lead to identify crash patterns, both spatially and statistically, associated with the infrastructure characteristics at road intersections, and therefore it can serve to improve safety.

Since crash data was available for the state of Sachsen (Germany) and the countries of France and Great Britain, the selection of the chosen cities started finding those located within these territories with population between 500,000 and one million inhabitants. After that, one city per country was selected considering the smallest difference in population density between the three cities, which led to have Leipzig in Germany, Marseille in France and Edinburgh in Great Britain. Even thought there are difference between the population and population density between these cities, this selection methodology allows to have the closest comparable cities under those criteria understanding that each country has a different urbanization process, and hence variation between cities from different countries is expected.

After choosing the three cities, a classification of road network intersections was carried out. Based on Wang & Akar (2018), we classified the intersections considering three infrastructure parameters: number of arms, presence of traffic signal and presence of cycling infrastructure. For achieving this, firstly, the infrastructure-related data was imported from OSM into a relational database using osm2pgsql and pgrouting. Secondly, every network junction was identified and grouped according to its intersecting way with the highest road hierarchy. Since the OSM network represents every possible traffic direction per carriageway, the junctions output included much more points than real intersections. Hence, we applied a density-based spatial clustering of applications with noise – DBSCAN (Ester et al., 1996), which led to have new intersection points based on the centroid of the clusters weighted by the highest road hierarchy. Finally, from these clustered intersections we proceed with the identification of the above-mentioned infrastructure parameters (arms, traffic lights and cycling infrastructure).

Having the clustered intersections, the spatial matching of cyclist crashes is still in progress, and additionally work will be conducted to reach the definitive results. This includes a spatial autocorrelation analysis and descriptive statistics based on the proposed intersection classification, with mapping visualisation comparing the cyclist safety situation in the three chosen cities.

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