An Integrated Information System for Road Traffic Accidents: The Lesvos Island, Greece, Case Study

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ABSTRACT

Road traffic accidents come at a high price: 1.25 million road traffic deaths occurred globally in 2013. As the road network and the environmental conditions contribute significantly in the cause of accidents, it is crucial to understand where and when they occur, in order to plan actions for road safety improvement. For this reason, the Region of the North Aegean, Greece, in collaboration with the University of the Aegean, has established a spatial database and a web-based geographic information system (webGIS) for the registration, storage, visualization and analysis of the traffic accidents occurred in its jurisdiction. In this article, besides the development and operation of the system, the authors present a spatio-temporal analysis of the data collected since 2004 for the island of Lesvos. Hot spots and risky periods were identified, leading to useful conclusions and directions for road safety improvements.

KEYWORDS

Geographic Web Services, Lesvos Island, Network Spatial Analysis, Open Source Software, Road Traffic Accidents, WebGIS

INTRODUCTION

Road traffic accidents are among the main causes of death or permanent disability in the world. According to World Health Organization (2015) there were 1.25 million road traffic deaths globally in 2013 – a figure that has plateaued since 2007, without any sign of an actual decline. Additionally, in World Health Organization (2004) was reported that approximately 16,000 people die every day worldwide from all types of injuries; deaths from traffic injury are accounting for 25% of this number. At the European Union, in 2014 almost 25,700 people did not make it home while more than 200,000 people came home with life-changing, serious injuries (European Commission, 2015). Although

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there is a significant improvement in comparison to the numbers reported in European Commission (2003), i.e. 40,000 deaths and 1,700,000 injuries, the situation is still socially unacceptable and difficult to justify to the citizen. There is still work to be done in order the goal of a 50% reduction in the number of road fatalities by 2020, starting in 2010 (when 31,500 deaths had occurred) to be reached (European Commission, 2010).

Ninety-percent of road traffic deaths occur in low- and middle-income countries, and while these countries also account for 82% of the world’s population, they nevertheless bear a disproportionate number of deaths relative to their level of motorization, as they account for only 54% of the world’s registered vehicles (World Health Organization, 2015). In addition, people who are low in social status sustain traffic injury more often than those who are high in social status (European Transport Safety Council, 2007).

Characteristics of the driver, the vehicle and the road/environment are involved in the challenge of traffic accidents and are therefore targets for preventive interventions. As the road network and the environmental conditions contribute at about 15% in the cause of accidents (Vogel & Bester, 2005; Great Britain Department of Transport, 2007; Ahmed, 2013), it is crucial to understand where and when they occur, in order to plan actions for road safety improvement. This is even more important for the secondary road network (rural and urban roads, not the motorways), since the highest number of fatalities occurs there (European Commission, 2010).

From the aforementioned observations it is obtained that the small coastal cities and islands in the Mediterranean Sea, are vulnerable to road traffic accidents, since they are usually characterized by economic recession and their road network is mainly secondary. In Greece, only the 0.6% of the road network consists of motorways (Tsantsanoglou & Saramoutsis, 2005). The analysis in Yannis and Papadimitriou (2012) confirms that Greece is one of the worst performing countries in EU in terms of road safety. The social cost of accidents for year 2008 is estimated more than 4 billion Euros. There were 100 dead by traffic accidents per million inhabitants in 2010 and 72 in 2015, while the same numbers for European Union were 63 and 51, respectively (European Commission 2010; 2015).

The need to reduce road accidents is more imperative in island regions, due to limited health facilities that often lead to deaths of seriously injured (Binns et al., 2010). During summer period, there is increased demand for medical services (Gould & Moon, 2000), which is not only based on the increased temporary population of the islands, but also in high risk behaviors by island visitors (Carey & Aitken, 1996; Petridou et al., 1997). As tourism is the main economic activity of many islands, especially in Greece (Spilanis & Kizos, 2015), the study of road accidents and the development of policies to limit them are essential.

One of the tools for monitoring and evaluating the efficiency of road safety policies in Europe is the development of the CARE database for the collection and management of data about road accidents resulting in death or injury (European Council, 1993). Objectives of CARE database are to: (a) identify and quantify road safety problems, (b) evaluate the efficiency of road safety measures, (c) determine the relevance of Community actions, and (d) facilitate the exchange of experience in this field. The Common Accident Data Set (CAdaS) model (Yannis et al., 2009) was adapted for data representation and storage, where a number of attributes are included for the coordinates and the road characteristics of the accident’s location. All Member States have the obligation to establish uniform statistics on road accidents resulting in death or injury that occur within their territories and disseminate them on CARE. However, most police authorities in Greece lack the appropriate equipment to record the exact location of the accident.

This paper presents the design, development and use of an integrated web-based geospatial information system for the easy and convenient recording, mapping and analyzing of road traffic accidents occurred in the jurisdiction of the (insular) North Aegean Region, Greece. It is based on open source technologies and incorporates transformations of classical spatial analysis methods to network spatial analysis methods, in order to quantify the spatial distribution of point events along networks. The system provides and utilizes open geographic web services, incorporates a convenient
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