Estimating the safety performance of urban intersections in Lisbon, Portugal

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ABSTRACT

According to official statistics, a large percentage of crashes in Portugal are reported on urban roads. For instance, from 2004 to 2007, about 70% of all injury accidents and 43% of the fatalities occurred inside urban agglomerations. This important safety problem has also been observed on the urban network of Lisbon. Understanding this significant problem, the Government of the Portuguese Republic via its research grant agency – The Foundation for Science and Technology – funded a project whose primary objective consists of developing tools that would help estimating the safety performance of various components of the urban highway system in Lisbon. This paper documents one component of the safety tools that were developed and describes the steps that were taken to develop predictive models for estimating the safety performance of signalized and unsignalized intersections of Lisbon. Several crash predictive models were developed using the Poisson-gamma modeling framework. Two types of models were estimated: flow-only and models with covariates. They were estimated using crash and other related data collected at 44 three-legged and 50 four-legged intersections for the years 2004–2007, inclusively. It was found that some highway geometric design characteristics were associated with the crashes occurring at urban three- and four-legged intersections in Lisbon.

1. Introduction

According to official statistics, a large percentage of crashes in Portugal are reported on urban roads. For instance, from 2004 to 2007, about 70% of all injury accidents and 43% of the fatalities occurred inside urban agglomerations (DGV, 2004, 2005, 2006; ANSR, 2007). This important safety problem has also been observed on the urban network located in and around Lisbon. On the urban network in Lisbon, more than 2400 crashes occurred during the same time period, and about 30% of all crashes involved a pedestrian.

In order to understand this significant problem, the Government of the Portuguese Republic funded a project via its research grant agency – The Foundation for Science and Technology – which had, as the primary objective, the development of tools that would help estimating the safety performance of various components of the urban highway system in Lisbon. No such tools exist in Portugal for estimating the safety performance of urban networks, hence the funding of this project. The research project titled "IRUMS – Safer Roads in Urban Areas" is carried out by the National Laboratory of Civil Engineering (LNEC) jointly with the Department of Engineering at the University of Coimbra, Coimbra. This project intends to develop methods for managing the safety of urban road networks, particularly those applied in Lisbon. The methods focused on estimating the expected crash frequencies, the identification of hazardous sites (or sites with promise) and subsequently select effective countermeasures to reduce the number and severity of crashes.

This paper documents one component of the safety tools that are currently under development. More specifically, this paper describes the steps that were taken to develop predictive models for estimating the safety performance of signalized and unsignalized intersections located in Lisbon. Several crash predictive models (CPMs) were developed using the Poisson-gamma modeling framework. Two types of models were estimated: flow-only and models with covariates. They were estimated using crash and other related data collected at 44 three-legged and 50 four-legged intersections for the years 2004–2007.

The paper is organized as follows. The first section provides a brief background about existing statistical models developed in Portugal and elsewhere in Europe. The second section describes the methodology used for estimating the CPMs. The third section presents the characteristics of the data used in this study. The fourth section summarizes the modeling results. The last section provides a summary of the work accomplished so far in this project.

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