MAKERERE UNIVERSITY

SPATIAL AND TOPOLOGICAL CHARACTERIZATION OF ROAD TRAFFIC ACCIDENTS IN RWANDA

BY

MUTABAZI TWAGIRA PETERSON

BSc. Civil (NUR)

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ABSTRACT

Worldwide, road traffic accident injuries and fatalities have risen to be among the leading deaths (Global Status Report (2013). The World Bank and World health organization joint publication reported 1.2 million deaths every year across the world due to road accident crashes and injuries. In 2010 world Governments declared 2011-2020 as the Decade of Action for Road Safety and targeted to reduce by 50% the predicted number of road accident fatalities by 2020. As a result, 88 countries have managed to reduce the deaths, however stabilizing the burden of road deaths remain a challenge in Low and Middle Income Countries that account for 90% of global road traffic accident deaths (Global status report 2013).

The fact that little is known about road traffic accidents in Rwanda triggered the researcher to conduct a study to establish what could be happening starting with understanding the magnitude of the road injury burden to set stage for substantial political and economic commitments to address the problem.

The main objective of the study was to develop spatial and topological characterization of road traffic accidents for a six-year period (2009-2014), and use the data to develop road accident prediction models incorporating traffic, vehicle, and geometric factors for critical segments on major highways. This was based on the assessment of available road traffic accident data from Rwanda National Police traffic and road safety department records.

Results show that road accident fatalities increased by 69% over the 6 years (2009-2014) with an average annual growth rate of 21% . Over the same period, the traffic volume grew by 87% with an average annual traffic growth of 12% per annum. There seems a correlation between increases in traffic volumes with volume of accidents. Spatial characteristics results show that road traffic accidents occur mostly in the City of Kigali road network, and five major radiating corridor roads connecting to provinces and neighboring countries. High fatalities and severe injury accidents mainly occurred on radial national roads from the City of Kigali. The fatal and serious injury accidents according to 2009-2014 data mainly involved vehicles and motorcycles or vehicles and pedestrians. This is explained by the fact that vehicles operate at high speeds and have wavy terrain which reduce chances of survival in case of accidents. On the other hand, accidents in the City of Kigali were mainly at junctions and often resulted in minor injuries and property damage only. This was attributed

to high traffic volumes, resulting in very low speeds, which increase the chances of survival in an accident.

The data collection, storage, and retrieval system was assessed and was found inappropriate for accident reporting due to lack of specific attributes of accidents required for engineering applications. The storage system lacked automation though computerization had just started and was in a very low level of technology hence the retrieval system too.

Results of a negative binomial regression to predict the total number of fatalities and serious injury accidents showed that these increased with AADT and length of section with combinations of several horizontal curves and steep descends. Model sensitivity analysis showed that the number of fatal and serious injury accidents increased by 12.53% for an increase in length of section of one kilometer. This has policy implications during design to limit the length of wavy sections for safety reasons.

From a policy perspective, it is important that national highways radiating from the City of Kigali should be secured for pedestrian and motorcycle traffic and this will result in a reduction of fatalities and serious injury accidents. Most accidents occurred on sharp horizontal curve combinations on a steep descend. Therefore policy applications in design and enforcement could be geared at improving these sections. The Study recommends future study with improved quality and quantity of traffic accident data to develop models to predict accident occurrence in urban networks.