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ESTIMATING ACCIDENT FREQUENCY AT SIGNALIZED INTERSECTIONS AS A FUNCTION OF TRAFFIC CONGESTION

by

Motasem Ahmad Al-Turk

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Under the Supervision of Professor Massoum Moussavi

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DISSERTATION TITLE

Estimating Accident Frequency at Signalized Intersections as a Function of Traffic Congestion

BY

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GRADUATE COLLEGE
UNIVERSITY OF NEBRASKA

ESTIMATING ACCIDENT FREQUENCY AT SIGNALIZED INTERSECTIONS AS A FUNCTION OF TRAFFIC CONGESTION

Motasem Ahmad Al-Turk, Ph.D.

University of Nebraska, 1995

Advisor: Massoum Moussavi

The need for an effective way to measure the effects of changes in traffic volumes and volume to capacity ratios (v/c) on accident frequency at signalized intersections was the motivation for this research. Today, different methods are incorporated by various agencies for determining accident reductions, but no widespread or uniformly accepted method has been established.

Many factors are believed to influence accident frequency. Some of these factors such as traffic volume and geometric and signal designs are easily observed, documented, and controlled while other factors such as regression to the mean, varying levels of accident reporting, and human behavior are not.

A new technique which compromises the effects of the uncontrollable factors and emphasizes the effects of the controllable factors was introduced and implemented in this research. Accident frequency in this new technique is also related to the conflicting movements to which the colliding vehicles belong. For a given type of accidents,

data sets including observed number of accidents, traffic volumes, and v/c ratios of the conflicting movements were sorted in ascending order by the appropriate parameter and then divided into groups of equal sizes. Average number of accidents, traffic volumes, and v/c ratios of the above groups were then used to develop series of least squares regression equations to predict the number of accidents in the a.m., p.m., and off peak periods. Equations were developed for the four most frequent collision types which included rear end, left turn leaving, left turn entering, and cross traffic collisions. These equations provided fairly good estimates when they were tested using an out of sample empirical data.

This research concluded that these equations can be used to help identify sites with unusually high accident frequencies and as an effective tool in evaluating benefits and costs for intersection improvements.

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Chapter 1

INTRODUCTION

Balancing the competing demands for roadway improvements is one of the most serious problems facing agencies responsible for urban streets. The engineer is required to improve roadway operation by reducing the extent and duration of congestion during peak periods at the same time when traffic flows continue to increase. The engineer is also concerned with improving safety for all users of the street system. There are reasonable sets of treatments which can help to achieve the desired objectives of smooth traffic flow or/and improve highway safety. But operating under financial constraints, the traffic engineer is faced with the problem of choosing between measures to improve safety or to upgrade highway traffic flow. Of course, certain traffic flow improvements may also result in safety enhancement; for example, adding a traffic lane could improve both traffic flow and safety. Nevertheless, there is little documentation on the interaction between safety and traffic flow treatments for roadway sections or street intersections.

This study is intended to determine the nature of the relationship, if any exist, between the degree of