Genetic Programming to Investigate Design Parameters Contributing to Crash Occurrence on Urban Arterials

Journal	Transportation Research Record: Journal of the Transportation Research Board
Publisher	Transportation Research Board of the National Academies
ISSN	0361-1981
Issue	Volume 2147 / 2010
Pages	25-32
DOI	10.3141/2147-04
Online Date	Friday, October 01, 2010

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Abstract

Nonlinear models were developed to estimate crash frequency on urban arterials with partial access control. These multilane arterials consist of midblock segments joined by signalized and unsignalized intersections (or access points). Crashes included in the analysis are of three major types: rear-end, angle, and head-on. Each crash type is further sorted into mutually exclusive categories on the basis of the roadway element responsible for the crashes: midblock segment, signalized intersection, and access point. Genetic programming (GP) is adopted for predicting crash frequency. GP, which is primarily based on genetic algorithms, uses the concept of evolution to develop models through the processes of crossover and mutation. The GP modeling approach gives independence for model development without restrictions on distribution of data. The models developed were compared to the basic negative binomial models. Morning and afternoon peak periods are observed to have fewer occurrences of rear-end crashes at all roadway elements. Higher traffic volume results in an increased number of angle crashes. Instances of angle crashes have increased at signalized intersections, even at lower maximum posted speeds. A higher average truck factor increases the instances of head-on crashes on midblock segments and at signalized intersections.