Announcing the Final Examination of Kirolos Haleem for the degree of Doctor of Philosophy

Time & Location: November 3, 2009 at 12:00 PM in ENG2 211 P
Title: Comprehensive Analytical Investigation of the Safety of Unsignalized Intersections

According to documented statistics, intersections are among the most hazardous locations on the roadway system. Many studies have analyzed the safety of signalized intersections, but did not put their major focus on unsignalized intersections. An important reason is the inadequacy and difficulty to obtain data at these intersections, as well as the limited crash counts. Unsignalized intersections can be differentiated from their signalized counterparts in that their operational functions take place without the presence of a traffic signal. In this dissertation, the most extensive data collection effort for unsignalized intersections was conducted. Data from 2500 unsignalized intersections were collected from six counties in Florida. Multiple approaches of analyzing safety at unsignalized intersections were conducted by modeling the total crashes, the most frequent crash types (rear-end as well as angle crashes), crash injury severity and access management. The traditional negative binomial (NB) model was used to model the frequency of total crashes, and some of the significant factors identified were the traffic volume on the major road, the existence of stop signs, the configuration of the intersection, and the median type on the major road. Afterwards, the Bayesian updating concept was used for updating the parameter coefficients for better prediction using different non-informative and informative prior structures with the NB and log-gamma distributions. The log-gamma distribution showed the best prediction capability. Crash injury severity at unsignalized intersections was analyzed using the ordered probit, binary probit and nested logit frameworks. Some of the factors that were found to contribute to the severity of crashes were the logarithm of annual average daily traffic (AADT) on the major road, the upstream and downstream distance to the nearest signalized intersection, existence of stop lines, left and right shoulder widths, and number of right and left turn lanes on the major approach. Also, heavily-populated and highly-urbanized areas experienced lower fatal/severe injury. The multivariate adaptive regression splines (MARS), which is capable of yielding high prediction accuracy, was used for analyzing rear-end and angle crashes. MARS yielded the best prediction performance while dealing with continuous responses. Additionally, screening the covariates using random forests before fitting MARS model showed the best results. Finally, an access management analysis was performed with respect to six median types (open, closed, directional, two-way left turn lane, undivided and mixed) based on median-related crashes. It was concluded that single-vehicle crashes were the most probable, followed by right-angle crashes. The binomial logit and bivariate probit models demonstrated the importance of median-related variables such as median width, speed limit on the major road, logarithm of AADT, and crash pattern. Of the identified research applications to reduce crash severity are prohibiting left turn maneuvers from minor intersection approaches. To reduce right-angle crashes, avoiding installing two-way left turn lanes at 4-legged intersections is essential. To reduce conflict points, closing median openings across from access points is recommended.

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Approved for distribution by Dr. Mohamed A. Abdel-Aty, Committee Chair, on September 29, 2009.
The public is welcome to attend.