Villwock, Natalie Marie. PhD, Purdue University, December, 2009. Evaluating the Feasibility of Predicting Safety at Novel Intersections. Major Professors: Dr. Andrew Tarko and Dr. Fred Mannering.

The safety of alternative intersections is largely unknown. Alternative intersections typically relocate the left-turn movement from the primary intersection with the objective of achieving operational and safety benefits. Studies on the operational benefits of alternative intersections are numerous. However, only a handful of studies have been published which provide information on the safety impact of alternative intersections. These studies are limited in number and spatial distribution. Information on the safety of alternative intersections is limited by the available safety analysis methods. Current methodologies, such as before-and-after analyses and safety prediction models, have limited applications at alternative intersections due to small sample sizes and regionally specific implementations. The work herein seeks to develop a methodology of predicting safety at alternative intersections by building an intersection from a microscopic perspective. Four models were developed. A binary logit model was developed to predict the likelihood of a merge crash at a merge conflict point, the likelihood of a diverge crash at a diverge conflict point, and the likelihood of a crossing crash at a crossing conflict point, respectively. A multivariate probit model was developed at the aggregate level to better understand what affects the likelihood of a merge, diverge, and crossing crash to occur at a merge, diverge, and crossing conflict point, respectively. In particular, this model provided information on possible interdependencies between the conflict types. At the aggregated level, a correlation was only found to exist between the likelihood of merge and diverge conflict points, respectively. To evaluate the proposed method, the binary logit merge conflict point model was applied to roundabouts as a case study. The results indicate that the average annual daily traffic variable seems to be dominating the predictive capability of the model; however the curvature of the dominant movement also significantly affected the likelihood of a merge crash at a merge conflict point. Finally, development of conflict diagrams for a multilane roundabout under consideration provided an indication that this type of roundabout may not completely eliminate crossing conflict points. The presence of crossing conflict points, which are more frequent and often more severe in nature, could explain the smaller reduction in safety associated with multilane roundabouts as compared with single lane roundabouts.