

## ABSTRACT

Hall, Thomas M. M.S.C.E., Purdue University, December 2014. Safety-related Behavior of Truck Drivers at Roundabouts on High-speed Roads. Major Professor: Andrew Tarko.

There is a recent trend of building roundabouts on high-speed roads, often with significant heavy vehicle traffic. With the increased presence of trucks on roundabouts, the issue of rollover has become a concern. Geometric features that allow excessive speed on the approach and entry have been connected to rollover, as well as sudden changes in crossfall and radius. However, the effect on the rollover threshold of changing the roundabout's circulatory superelevation is not fully understood. The impact of aggressive driving behaviors, as displayed by high driver speed far from the roundabout, as well as errors that are manifested by the driver maintaining excessive speed in close proximity to the roundabout, should also be examined.

This thesis describes a rollover model more generalized than those previously used for design considerations. It accounts for the intricacies of semi-trailers and other heavy vehicles by incorporating both complex trailer paths that do not conform to the road alignment and the resulting vehicle tilt. The proposed model is applied in the aforementioned scenarios after introducing  $\Delta v$  - the difference between the critical rollover speed determined from the model and the actual speed.

In the comparison of inward vs. outward circulatory superelevation, the study revealed that the 2% inward scenario produces a statistically significant and 1.5-1.9 mile per hour higher (depending on the assumed trailer loading)  $\Delta v$  than 2% outward. As expected, the difference becomes greater (1.8-2.4 mph) when the inward superelevation is increased to 3%. However, these differences are too weak to recommend the inward design given its other shortcomings. The study also showed that aggressive driver behavior, as exemplified by speed, does not have a significant effect on the critical rollover threshold. However, drivers who maintain high speeds in close proximity to the roundabout do show a greater tendency to encroach on critical rollover speed. Properly placed measures such as Variable Message Signs (VMS) can be utilized to help slow these drivers down. Better driver training is also recommended. A final accommodation measure, based on a review of literature and crash reports, involves improvement of the truck apron design so they are easily traversable and more conspicuous.