The weather condition is a crucial influence factor on road safety issues. Fog is one of the most noticeable weather conditions, which has a significant impact on traffic safety. Such condition reduces the road's visibility and consequently can affect drivers' vision, perception, and judgments. The statistical data shows that many crashes are directly or indirectly caused by the low-visibility weather condition. Hence, it is necessary for road traffic engineers to study the relationship of road traffic accidents and their influence factors. Among these factors, the traffic volume and the speed limits in poor visibility areas are the primary reasons that can affect the types and occurring locations of road accidents. In this thesis, microscopic traffic simulation, through the use of VISSIM software, was used to study the road safety issue and its influencing factors due to limited visibility. A basic simulation model was built based on previously collected field data to simulate Interstate 4 (I-4)'s environment, geometry characteristics, and the basic traffic volume composition conditions.

On the foundation of the basic simulation model, an experimental model was built up to study the conflicts' types and distribution places under several different scenarios. Taking into consideration the entire 4-mile study area on I-4, this area was divided into 3 segments: section 1 with clear visibility, fog area of low visibility, and section 2 with clear visibility. Lower speed limits in the fog area, which were less than the limits in no-fog areas, were set to investigate the different speed limits' influence on the two main types of traffic conflicts: lane-change conflicts and rear-end conflicts. The experimental model generated several groups of traffic trajectory data files. The vehicle conflicts data were stored in these trajectory data files which, contains the conflict locations' coordinates, conflict time, time-to-conflict, and post-encroachment-time among other measures. The Surrogate Safety Assessment Model (SSAM), developed by the Federal Highway Administration, was applied to analyze these conflict data.

From the analysis results, it is found that the traffic volume is an important factor, which has a large effect on the number of conflicts. The number of lane-change and rear-end conflicts increases along with the traffic volume growth. Another finding is that the difference between the speed limits in the fog area and in the no-fog areas is another significant factor that impacts the conflicts' frequency. Larger difference between the speed limits in two nearing road sections always leads to more accidents due to the inadequate reaction time for vehicle drivers to brake in time. The results of this research have a certain reference value for studying the relationship between the road traffic conflicts and the impacts of different speed limits under fog condition. Overall, the findings of this research suggest follow up studies to further investigate possible relationships between conflicts as observed by simulation models and reported crashes in fog areas.

Major: Civil Engineering

Educational Career:
Bachelor's of Traffic Engineering, BS, 2012, Beijing Jiao Tong University

Committee in Charge:
Essam Radwan, Chair, CECE/CECS
Mohamed Abdel-Aty, CECE/CECS
Hatem Abou-Senna, CECE/CECS

Approved for distribution by Essam Radwan, Committee Chair, on October 14, 2014.

The public is welcome to attend.