A GENERALIZED FORMULATION FOR TIME-TO-COLLISION SAFETY INDICATOR AND ITS APPLICATION

Navid Nadimi, Ph.D. Candidate, School of Civil Engineering Iran University of Science and Technology, Tehran, Iran[1]
Seyed Saber Naseralavi, Assistant Professor, Faculty of Engineering, Shahid Bahonar University, Kerman, Iran[2]
navidnadimi@iust.ac.ir[1]
ssna60@yahoo.com, (+98-341) 2462716 [2]

Abstract

Today Advanced Driver Assistance Systems (ADAS), as a field of ITS, are so important to reduce the number of driver errors and thereby the number of accidents. Time to collision (TTC) is an important time based safety indicator for detecting rear-end conflicts in traffic safety evaluations. TTC, refers to the time remaining before the rear-end accident if the course and speed of vehicles are maintained. TTC, has proven to be an effective measure for discriminating critical from normal behaviors in car-following situations. TTC is also used in Collision Avoidance Systems (CAS), which is an example of ADAS, as a proper warning strategy. A major weakness of the TTC notion is the assumption of constant velocities during the course of an accident. In this paper we utilize equations of motion to develop a generalized formulation for TTC by relaxing the assumption of constant velocity, constant acceleration and so on. This paper also illustrates how this concept can be applied to real world data, therefore the comprehensive and detailed data gathered in the NGSIM project on I-80 freeway is used. Then, car following situations are chosen from this data and for more simplicity, TTC is just calculated based on the assumption of constant speed, constant acceleration and linear acceleration for leading&following vehicles. Results indicate that, in the third case (linear acceleration) the average duration of exposing to critical TTC values is greater than the others. So applying TTCs based on the assumption of linear acceleration in CAS, would decrease driver errors more than other cases.

Keywords: Generalized formulation, Time to collision, Equations of motion, Car-following, safety indicator