World Academy of Science, Engineering and Technology
International Journal of Transport and Vehicle Engineering
Vol:14, No:08, 2020

Microsimulation of Potential Crashes as a Road Safety Indicator

Authors : Vittorio Astarita, Giuseppe Guido, Vincenzo Pasquale Giofre, Alessandro Vitale

Abstract : Traffic microsimulation has been used extensively to evaluate consequences of different traffic planning and control policies in terms of travel time delays, queues, pollutant emissions, and every other common measured performance while at the same time traffic safety has not been considered in common traffic microsimulation packages as a measure of performance for different traffic scenarios. Vehicle conflict techniques that were introduced at intersections in the early traffic researches carried out at the General Motor laboratory in the USA and in the Swedish traffic conflict manual have been applied to vehicles trajectories simulated in microscopic traffic simulators. The concept is that microsimulation can be used as a base for calculating the number of conflicts that will define the safety level of a traffic scenario. This allows engineers to identify unsafe road traffic maneuvers and helps in finding the right countermeasures that can improve safety. Unfortunately, most commonly used indicators do not consider conflicts between single vehicles and roadside obstacles and barriers. A great number of vehicle crashes take place with roadside objects or obstacles. Only some recent proposed indicators have been trying to address this issue. This paper introduces a new procedure based on the simulation of potential crash events for the evaluation of safety levels in microsimulation traffic scenarios, which takes into account also potential crashes with roadside objects and barriers. The procedure can be used to define new conflict indicators. The proposed simulation procedure generates with the random perturbation of vehicle trajectories a set of potential crashes which can be evaluated accurately in terms of DeltaV, the energy of the impact, and/or expected number of injuries or casualties. The procedure can also be applied to real trajectories giving birth to new surrogate safety performance indicators, which can be considered as “simulation-based”. The methodology and a specific safety performance indicator are described and applied to a simulated test traffic scenario. Results indicate that the procedure is able to evaluate safety levels both at the intersection level and in the presence of roadside obstacles. The procedure produces results that are expressed in the same unity of measure for both vehicle to vehicle and vehicle to roadside object conflicts. The total energy for a square meter of all generated crash can be used and is shown on the map, for the test network, after the application of a threshold to evidence the most dangerous points. Without any detailed calibration of the microsimulation model and without any calibration of the parameters of the procedure (standard values have been used), it is possible to identify dangerous points. A preliminary sensitivity analysis has shown that results are not dependent on the different energy thresholds and different parameters of the procedure. This paper introduces a specific new procedure and the implementation in the form of a software package that is able to assess road safety, also considering potential conflicts with roadside objects. Some of the principles that are at the base of this specific model are discussed. The procedure can be applied on common microsimulation packages once vehicle trajectories and the positions of roadside barriers and obstacles are known. The procedure has many calibration parameters and research efforts will have to be devoted to make confrontations with real crash data in order to obtain the best parameters that have the potential of giving an accurate evaluation of the risk of any traffic scenario.

Keywords : road safety, traffic, traffic safety, traffic simulation
Conference Title : ICCEMTS 2020 : International Conference on Civil Engineering and Modelling Transportation System
Conference Location : Paris, France
Conference Dates : August 27-28, 2020

Open Science Index, Transport and Vehicle Engineering Vol:14, No:08, 2020 publications.waset.org/abstracts/128602.pdf