Safety of vulnerable road users is one of the main traffic safety issues today. Modern vehicles offer high level of protection to both drivers and passengers, but pedestrians and cyclists are left with significantly lower chances to survive in a road accident. Vehicle-pedestrian collisions at uncontrolled pedestrian crossing remain one of the most serious unsolved road-safety problems, where the focus must be set on prevention rather than mitigation of consequences. Along with traditional measures, such as rebuilding pedestrian crossings and installation of traffic lights, one can apply contemporary cooperative intelligent transport systems (C-ITS) that would warn both the vehicles and the road users of potential danger. This article aims to estimate the potential of such a warning system as well as to draw recommendations for its design.

Efficiency of the system would very much depend on the timing of warning signals. The main question that needs to be answered is whether such signals can be provided early enough to prevent collisions without the necessity of giving false positive signals just in case. To answer this question, in Tallinn, Estonia there is held a case study, which aims to determine typical road accidents at uncontrolled crossings, propose warning signals’ timing and model road users’ possible reactions to the signals.

The case study consists of three stages. The first stage determines the typical behavioral patterns of driver and pedestrian, which lead to road accidents. It helps to understand, in which situations the warning system should function. For this, researchers carry out traffic conflict studies at uncontrolled crossings with traffic filmed both in winter and summer seasons and video analyzed with the help of semi-automated software. Research select and describe serious conflicts as well as validate them in accordance with vehicle-pedestrian accident data from police and traffic insurance databases. Thereafter, the validated traffic conflicts are grouped according to similarity in behavioral patterns of road users and thus typical traffic conflicts are determined. These conflicts represent typical vehicle-pedestrian accidents at uncontrolled pedestrian crossings.

The second stage of the research analyzes road users’ behavior in typical conflicts to determine parameters like speed, trajectory, distance to potential collision point, time to collision, etc. Among other factors, the research estimates reaction times and potential stopping distances, based on road conditions and peculiarities of different braking systems. The work results in proposal for optimal warning signal timing for prevention of each typical road accident.

The third stage of the study models typical accidents based on each typical conflict. Warning signals are added into the road accidents models and behavior of road users upon receiving the warning is simulated. This simulation assumes giving warning signals to vehicles as well as to drivers and pedestrians. Researchers play though different scenarios, try various vehicle types and imitate different road conditions. As a result, the group draws the conclusion as to whether it is possible to give warnings in adequate time to prevent collisions under different circumstances. According to the findings, researchers give recommendations for optimal warning signals’ timing as well as to the design of the system, which would be capable of detecting and preventing typical vehicle-pedestrian conflicts by giving warning signals.