Pedestrian Safety through Vehicle-Based Countermeasures

Abstract

On-board vehicle safety features are becoming increasingly high-tech. Not the least of such innovative approaches are devices aimed at protecting pedestrians and cyclists. These range from structural changes and add-on components that provide crash protection, to systems aimed at preventing vehicle collisions with vulnerable road users.

Résumé

Les dispositifs de sécurité intégrés aux véhicules sont de plus en plus de haute technologie. Il importe de souligner, parmi ces approches novatrices, les dispositifs visant à protéger les piétons et les cyclistes. Les possibilités vont de changements apportés dans la structure et les composants ajoutés qui fournissent une protection au moment de la collision à des systèmes destinés prévenir les collisions entre véhicules et usagers vulnérables.

Not surprisingly, pedestrians, cyclists, and motorcyclists are especially vulnerable in collisions with much more massive, and much faster moving, motor vehicles. Even at relatively low contact speeds the outcome for such individuals can be serious injuries or even fatalities. In jurisdictions such as Europe, where the involvement of vulnerable road users in serious collisions is greater than in North America, specific consideration has been given to the protection of these individuals through vehicle-based countermeasures.

In the late 90's the European New Car Assessment Programme (EuroNCAP) began incorporating safety ratings for vehicles based on pedestrian-friendly designs. In 2009, the score from a series of test procedures seeking to quantify the potential for injury mitigation against vehicle-pedestrian impacts became an integral part of the overall vehicle safety star-rating scheme.

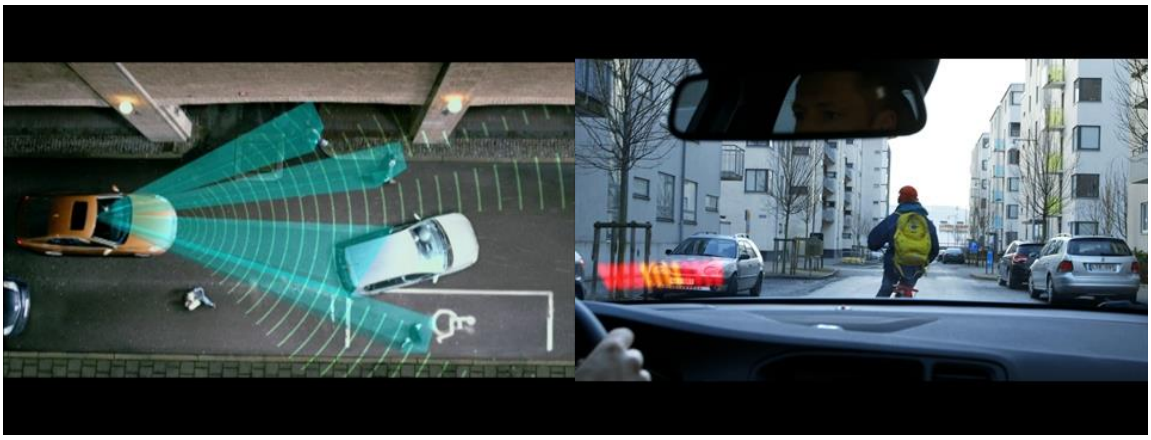
Structural changes to motor vehicles, necessitated by the desire of manufacturers to obtain good pedestrian protection scores in EuroNCAP tests, have included the provision of bumpers which readily deform and spread the load path when they hit a pedestrian's leg; the removal of unnecessarily stiff portions of the edges of the hood; and allowing clearance between the top surface of the hood and the underlying structures of the engine assembly in order to cushion head contacts.

While this latter aspect has often been accommodated by re-packaging components in the engine compartment, an alternative approach has been to provide a deployable hood assembly. Typically, contact sensors located in the front bumper identify an impact with a pedestrian and the vehicle's hood is automatically raised through the use of springs or a pyrotechnic charge.

Volvo’s Pedestrian Airbag Technology System

A more recent innovation, developed by Volvo Car Corporation, has been the deployment of an external air bag that both lifts the hood in order to create deflection space, and provides a shield over the bottom of the windshield frame and the lower portions of the front roof pillars to protect against head contact with these stiff structures.

Volvo, a company renowned for its vehicle safety innovations, has also developed a series of countermeasures designed to locate vulnerable road users ahead of the vehicle’s path of travel, predict their likely movements, and identify hazardous situations where a collision might occur. In such cases, the driver is alerted, while the vehicle itself is capable of fully applying the brakes in order to prevent a crash or at least reduce the impact speed.



Volvo’s Pedestrian and Cyclist Detection with Full Auto-Brake System

The Pedestrian Detection with Full Auto-Brake system uses forward-looking radar, digital cameras, and sophisticated image-processing systems to identify specific objects ahead of the vehicle as pedestrians, track their motion relative to that of the vehicle, predict potential conflicts, and monitor any motion of a pedestrian into the vehicle's path. The system alerts the driver through an audible warning signal and a flashing warning light in the vehicle's head-up display.

The braking system is pre-charged and, if the driver does not react to the warning such that a collision becomes imminent, full brake application is commanded automatically. The system can avoid a collision with a pedestrian at vehicle speeds up to 35 km/h, and can reduce the impact speed by this amount in the case of higher travel speeds.

Most recently, Volvo has extended the functionality of this system to accommodate cyclists and is currently working to provide a means of collision avoidance or mitigation against impacts with wild animals such as deer and moose.

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