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Structural Change Promoting Gender Equality in Research Organisations

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Dr Astrid Linder is the Research Director of Traffic Safety at The Swedish National Road and Transport Research Institute (VTI). She is head of the Traffic Safety division at VTI. She is representing VTI in the European network FESRI and is member of the steering group of the PIN panel of ETCS (European Traffic Safety Council). Her research experience is in the area of traffic related injury prevention, whiplash injuries, mathematical simulations, biomechanics and crash test condition specifications. She has a Ph.D. in Mechanical Engineering in the area of vehicle safety and a M.Sc. in Engineering Physics from Chalmers University in Sweden. Her Ph.D. focused on whiplash injuries in rear impacts and dummy development and dynamic seat test related to these injuries. She has coordinated the EU funded project ADSEAT, in which a finite element model of a crash test dummy of an average female has been developed. She has published extensively in both scientific journals and at international conferences during the last two decades.

Astrid Linder

Traffic Safety at The Swedish National Road and Transport Research Institute (VTI)

Neck injury prevention: Male and female occupant models in crash testing

Whiplash injuries sustained in vehicle crashes are a worldwide problem. It is estimated that annually, 800 000 citizens suffer whiplash injuries in the European Union annually. 15 000 of these injuries result in long term suffering with an associated socio-economic impact of approximately Euro 10 billion per annum (insurance estimates). In Sweden, such injuries account for approximately 70 percent of all injuries leading to disability sustained in to vehicle crashes. The majority of those experiencing initial neck symptoms recover within a week of the car crash. However, 5–10 percent of individuals experience different levels of permanent disabilities. Injury statistics from the mid- 1960's until today all show that females have a higher risk of sustaining whiplash injuries than males, ranging from 1.5 to 3 times higher.

Crash test dummies are used when developing and evaluating the occupant protection performance of a vehicle. At present, the only commercially available crash test dummy for rear impact testing, the BioRID, represents an average male. Anti-whiplash systems for passenger vehicles on the market today can reduce the injury risk, however, recent evaluation by the insurance industry has shown that males, more so than females, benefit from the recent improvements in the protective performance of seats. Consequently, current seats and whiplash protection systems are primarily adapted to the 50th percentile male dummy available today, without considering female properties, despite a higher whiplash injury risk in females.

The EU funded project "Adaptive Seat to Reduce Neck Injuries for Female and Male Occupants" (ADSEAT) project has therefore aimed to establish the properties of an average female and to implement such properties into a virtual crash test model. In the project ADSEAT the world first virtual crash test dummy model of an average female has been developed.

Results

The ADSEAT project was an EU funded project within the 7th Framework which started on 1 October 2009 and ended 31 March 2013. The overall objective of ADSEAT has been to provide guidance on how to evaluate the protective performance of vehicle seat designs aiming to reduce the incidence of whiplash injuries. The work concentrates on evaluating the protective performance of seats beneficial to female, as well as, male motor vehicle occupants. For this purpose a Finite Element (FE) model, called EvaRID (Eva – female / RID – Rear Impact Dummy), of an average female dummy was developed. This new research tool has be used in conjunction with the currently available rear impact dummy of an average male, the BioRID, when evaluating enhanced whiplash injury protection. In addition, a prototype dummy model of an average female, named BioRID 50F has been constructed. These models have been used as research tools in conjunction with the current low severity rear impact model of an average male when assessing the safety performance of car seats. BioRID 50F has been positioned in seats in the test conditions similar to those performed by Euro NCAP. The comparison shows that different seat designs can substantially influence the dynamic response of an average sized male or female occupant in a rear impact. These research results show how vehicle safety assessment can be improved and have the potential to influence the consumer and legislation testing, and thus reduce the risk of soft tissue neck injuries in the future. These results have been published in scientific journals and conference proceedings during the project and have been made available to the community through the interactive website www.adeseat.eu.