

ADSEAT



An EU funded project within the 7th Framework Programme

Adaptive Seat to Reduce Neck Injuries for Female and Male Occupants

Citizens who annually suffer
whiplash injuries in the EU

800 000

Socio-economic impact of approximately

10 billion Euros

**1.5 to 3 times
higher risk**

for females to sustaining whiplash injuries than males

WHIPLASH INJURIES sustained in vehicle crashes are a worldwide problem. It is estimated that 800 000 citizens suffer whiplash injuries in the European Union annually. 40 000 of these injuries result in long term suffering with an associated socio-economic impact of approximately Euro 10 billion per annum. 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. Whiplash injuries occur at relatively low velocity changes (typically below 25 km/h), and in impacts from all directions. Rear impacts occur most frequently in crash statistics.

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

Females and males have different anthropometry and mass distribution, which may influence the interaction of the upper body with the seat back rest and head restraint, and thus the injury risk. 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 ADSEAT project has therefore aimed to establish the properties of an average female and to implement such properties into a virtual crash test dummy model.

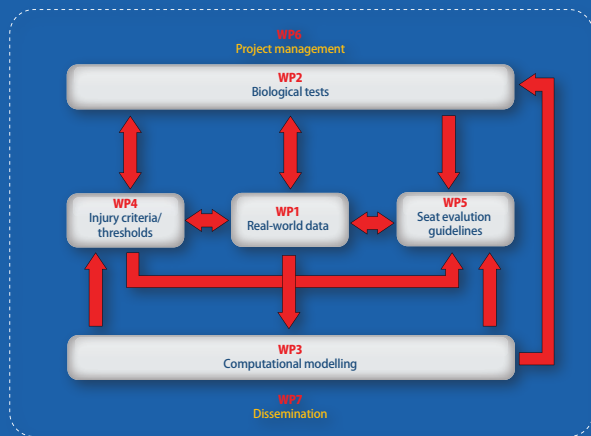
REDUCE WHIPLASH INJURY – FOR BOTH MALES AND FEMALES

The overall objective of ADSEAT has been to improve seat design to reduce whiplash injury. The project has focused on innovative adaptive seat design that can be adjusted to provide benefit for both male and female occupants.

By focusing project resources on the latter group, what influence gender and additional factors have on whiplash injury risk will be highlighted. The project aims at establishing the properties for a model of an average female and to implement those in a finite element model in order to provide an improved tool for the development and evaluation of adaptive systems, with special focus on protection against whiplash injuries. 🌟

ADSEAT WORKPACKAGES

The ADSEAT project has been divided into 7 Work Packages (WP), including management and dissemination (WP 6–7).



WP1 Real world data analysis

Extensive literature review and analysis of databases was carried out. Real world data analysis showed that existing whiplash protection concepts are more effective for males than females, with a 45% risk reduction in permanent medical impairment for females and 60% for males.

WP2 Biological tests

Test data from volunteer tests using males and female volunteers in identical conditions were collected and analysed. A new acceleration sled test set-up with a high speed X-ray movie recording unit was installed for testing. The volunteer data was used for the development and evaluation of the virtual model described below.

WP3 Computational modelling

A finite element dummy model of an average female, called EvaRID, was developed. The evaluation

shows that the model response correlates reasonably well with the volunteer test data, but further model refinement will be needed.

WP4 Injury criteria for females

The injury risk was analysed, assessing the usefulness of currently used neck injury criteria and comparing injury predictors for males and females based on computer simulations and sled tests. Theoretical suggestions were developed and investigated by sled testing and computer simulations. Modified versions of the injury criteria, NIC and Nkm, appeared the most applicable to use when assessing female injury risk.

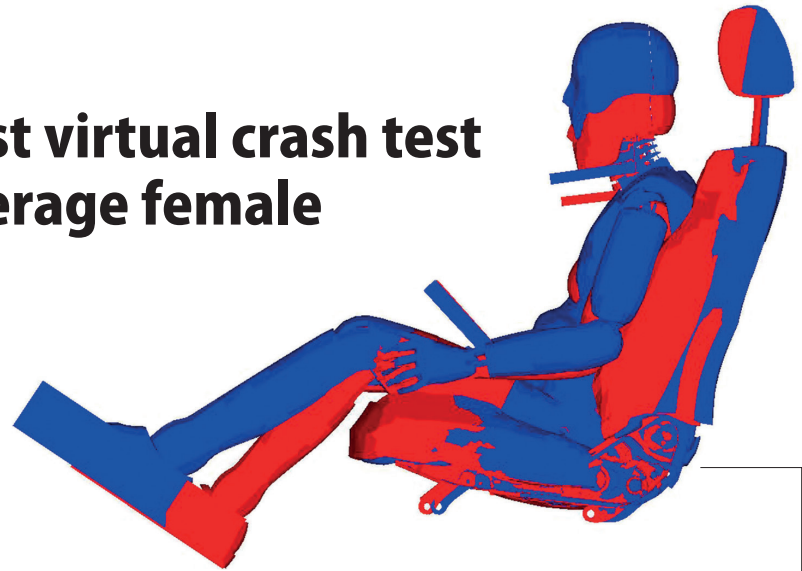
WP5 Seat evaluation guidelines

Guidance on how to evaluate the protective performance of vehicle seats with female as well as male motor vehicle occupants in mind is provided.

EvaRID – the world’s first virtual crash test dummy model of an average female

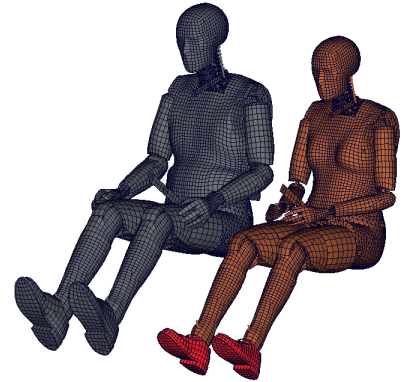
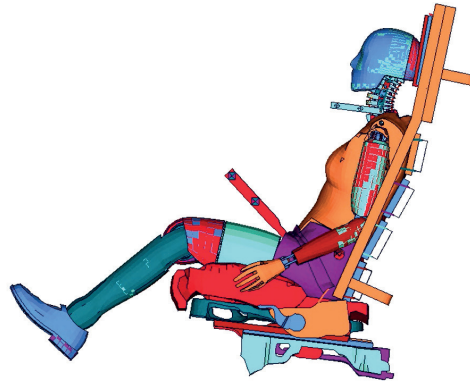
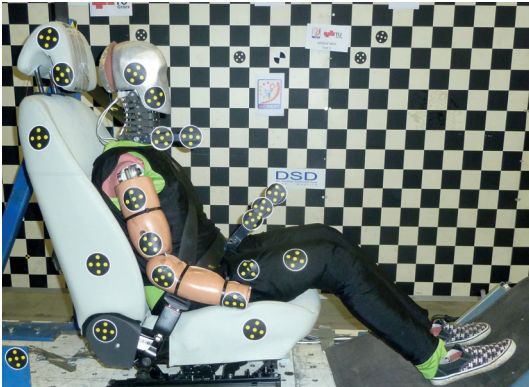
In the ADSEAT project, a unique virtual dummy model of an average female for rear impact testing has been developed. The developed model makes it possible, for the first time in the history of crash testing, to address occupant protection for both females and males.

The new model is called EvaRID (Eva female, RID – Rear Impact Dummy). For the development of the model, the anthropometry of the average female was established based on data found in the published scientific literature. Data from volunteer tests using male and female volunteers in identical test conditions were collected and analysed, and corridors for dynamic female response were established. New volunteer tests were performed in a seat that allowed for larger head restraint gaps. The results have been published



in scientific journals and conference proceedings during the project and have been made available to the community. Licenses for the use of EvaRID are available from the ADSEAT partner, Humanetics. In addition, a prototype dummy model of an average female, named BioRID 50F has been constructed. Further developments and applications of the BioRID 50F are foreseen in 2013 through joint efforts between partners of the ADSEAT consortium.

Anthropometric difference between EvaRID (red represents an average female) and BioRID (blue represents an average male).



BioRID 50F (left), virtual dummy model EvaRID (middle), and BioRID and EvaRID next to each other (right). (Picture of BioRID with courtesy of Dynamore).

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.

The socio-economic impact of the project has been established. A design illustrator based on generic seat simulations with BioRID II, the dummy model of an average male, and EvaRID, the dummy model of an average female, has been developed. The illustrator is available to the public on the ADSEAT website, www.adseat.eu, to demonstrate the improved protection male and female occupants will have in a rear impact car crash. 🚗



RESULTS OF ADSEAT

The ADSEAT project was active between October 2009 and March 2013 and has resulted in a variety of outcomes:

- A computational dummy model of an average female has been developed. The model called EvaRID (Eva female, RID – Rear Impact Dummy), incorporates information on the anthropometry of the average female, based on data found in the scientific published literature.
- A prototype dummy model, called BioRID 50F, was constructed. Sled testing with this device allowed direct comparison to the dynamic performance of the existing BioRID II dummy, based on a male.
- Newsletters, describing the most recent results of ADSEAT were distributed to more than 600 e-mail recipients.
- A large number of publications and presentations such as, Journal of Traffic Injury Prevention, a PhD thesis at Chalmers University, as well as, conferences such as IRCOBI 2010 and 2012, TRA 2012 and ESV 2011.

PARTNERS

ADSEAT has 12 partners and was funded by the 7th Framework Programme of the European Commission DG Research. For more information, please visit the website www.adseat.eu.



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CHALMERS



Folksam



Adaptive Seat to Reduce Neck Injuries for Female and Male Occupants (ADSEAT)

ADSEAT, short for Adaptive Seat to Reduce Neck Injuries for Female and Male Occupants, is an EU Commission funded project within the 7th Framework Programme, has predominantly focused on whiplash injuries. The aim of the project has been to improve safety for vehicle occupants by making recommendations for future evaluation of the effectiveness of anti-whiplash systems.

