



APROSYS FINAL EVENT

Integrated Project on Advanced Protection Systems



Classic Assessment and Test Tools

Human body models

Improved Injury Criteria

FUNCTIONALITY

Injury criteria and the supporting injury risk functions provide the link between measurements from an evaluation tool and the risk of injury for a human occupant. It is expected that improved knowledge on human body mechanical behaviour and tolerance to injury under dynamic loading will help with the development of improved injury criteria for use with the latest evaluation tools.

EXPLOITATION

FE models were supported through work on head injury criteria and provision of material property and biomechanical response data. Provisional injury risk functions for the THOR dummy were developed so that meaningful comparison between THOR and Hybrid III test results can be made.

SOCIO-ECONOMIC IMPACT

The results produced through this work help to ensure that the level of confidence in risk functions are appropriate for their use and therefore that the predicted benefit arising from new test procedures can be realised. Many work areas are being taken forward in FP7 research projects and other fora.

TECHNICAL DESCRIPTION

Objective

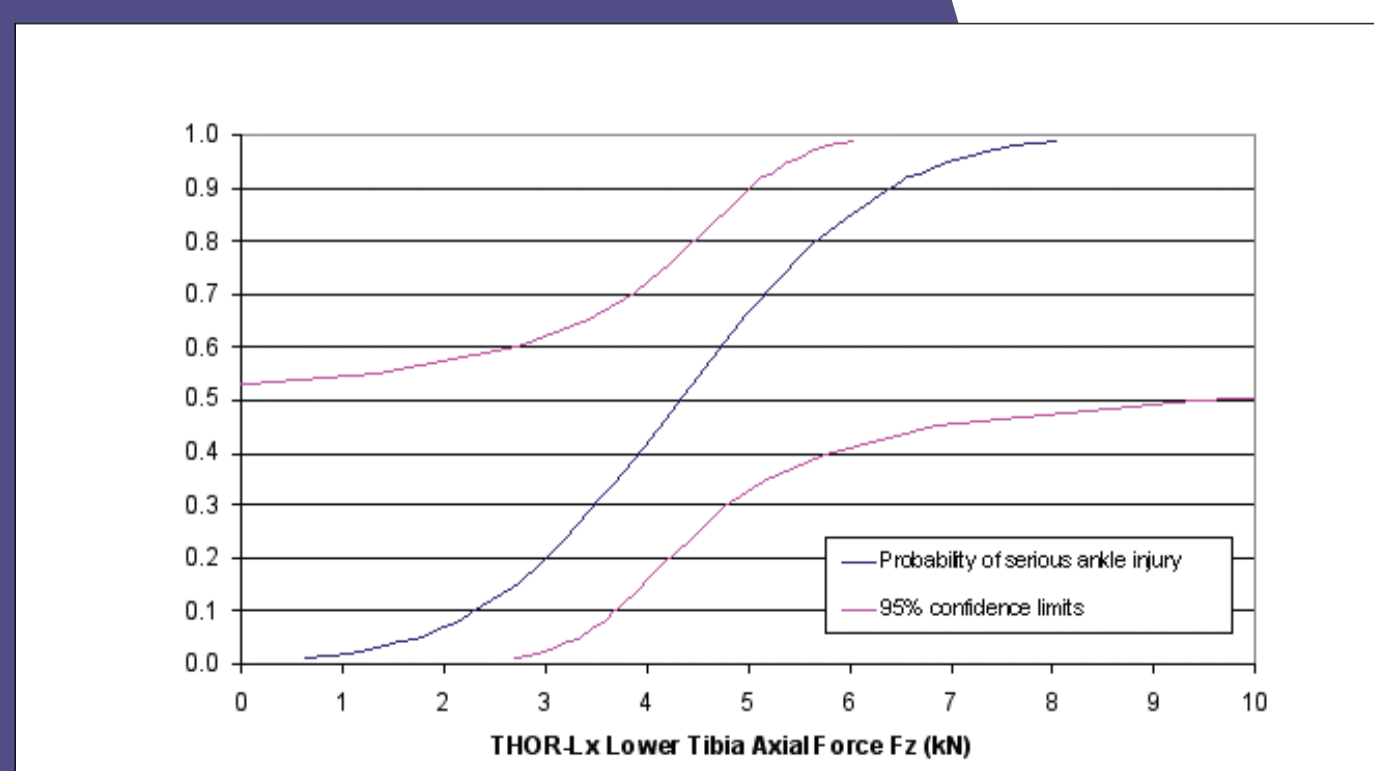
To provide improved knowledge on human body mechanical behaviour and tolerance to injury under dynamic loading, leading to reference mechanical data to develop new or improved crash test dummies and numerical human body models and leading to injury criteria to be measured on these evaluation tools.

Approach

In order to support human body modelling, fundamental tissue and organ mechanical behaviour at high strain rates was studied, focussing on brain tissue, thorax and abdomen organs.

Injury risk statistics, scaling and criteria

The statistical methods used to predict injury probability for a given severity of impact were reviewed. Advice was then prepared as to the most appropriate statistical methods to be used with certain types and quantities of biomechanical data.



Frontal impact criteria

Data from new thorax tests with PMHS was combined with existing data and matched with dummy tests to provide information on thoracic injury criteria for the THOR dummy.

An experimental programme of impacts to the abdomen of volunteers was defined and undertaken. These tests provided new knowledge of abdominal behaviour under load; around which an advanced sensor was developed for measuring such loads in a dummy.



Impactor test on a PMHS lower leg (left) and impact location on a volunteer's abdomen (right)

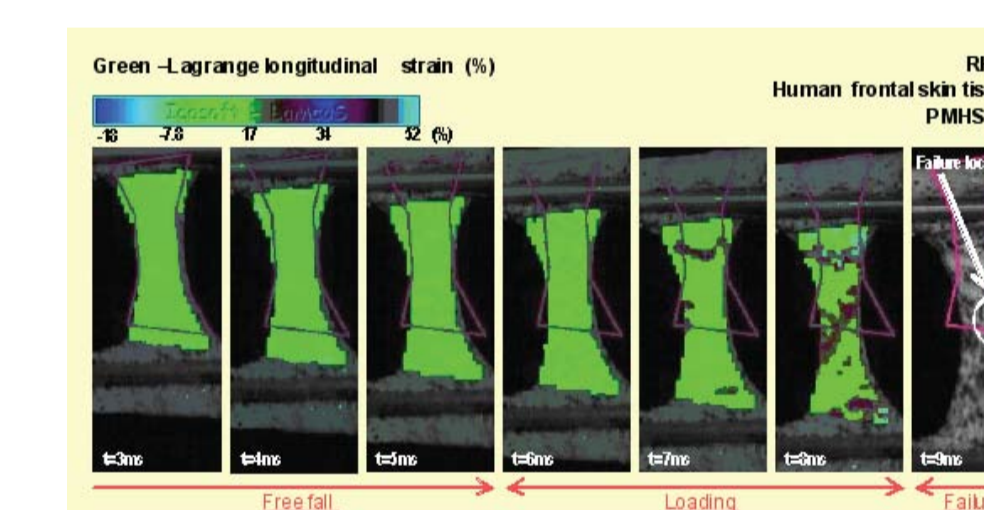
Side impact criteria

Two main actions were completed within this area; the first was simulation of side impact tests using current models to investigate discrimination between injury and no injury outcome cases.

Also, Sub system PMHS (Post-Mortem Human Subject) tests were conducted to provide additional information on human behaviour under such loading conditions.

Tissue behaviour and failure

Data on the material properties of human tissues were collated and incorporated in a tool for scaling those properties for different groups of occupants (children, small females, and the elderly, etc.).



Conclusion

Extensive literature survey and additional biomechanical experiments allowed to provide updated criteria for injury risk evaluation that can be used with the new generation dummies and numerical models of the human body.

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