

## **Ongoing Researches on Pedestrian Leg Injuries Assessment Performed by INRETS in Relation with EEVC WG 17**

INRETS has started a research based on numerical simulations and using results of tests already performed to determine the most relevant procedure to test high bumper cars, and to analyse how to assess injuries related to bonnet leading edge.

### High bumper cars

Car to pedestrian tests will be simulated using a FEM model of a (small) car already tested with a PMHS and by EuroNCAP, and the FEM LLMS leg model to which a hybrid III upper body is attached. The car front stiffness will be modified to make it more friendly using the results of a bumper EuroNCAP test performed on a car which got 4 stars at EuroNCAP.

Four series of simulations will be done:

- Simulation with the normal car and comparison with PMHS test
- Simulation with softened car with the same geometry
- Simulation with the same car raised of 5 cm
- Simulation with the same car raised of 10 cm

All the simulations will be performed once with a full human body model, and then duplicated using a leg alone (LLMS) FEM model

The analysis will concentrate on the comparisons of knee loadings and on the determination of the effect of the upper body on the knee loadings (values and timing). This work would allow to us to select the most relevant test procedure: using the existing leg impactor in the same conditions as for low bumpers, or raising the impactor at the knee level (worse case) or using a leg impactor with an upper body mass, or....

This work is planned to be completed by mid 2006.

Bonnet leading edge.

Simulations will be performed using FEM models of three cars adapted to a more pedestrian friendly front, and the same human model used for high bumper analysis (LLMS and Hybrid III upper body)

The analysis will concentrate on the determination of injury mechanisms in the contact between the thigh and the front of the bonnet, and the determination of which car shape and stiffness present a risk and then need to be tested.

The analysis will compare the injury mechanism with the existing upper leg impactor to see if we can test the BLE with a guided impactor, or if the impactor needs to be free in its motion during the impact.

This research is planned to be completed before end of 2006.

The results of the above researches will be made available to EEVC WG 17 and IHRA PS WG.