Pre- & post-processing tools in ANSA & META for Pedestrian Safety simulation
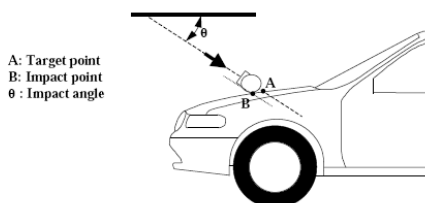
Introduction

Regulations

European regulations, for pedestrian safety, were introduced in the 90s to meet the goal of enhancing the pedestrian protection and reducing the number of pedestrian fatalities.

Since then, pedestrian friendly design has changed the styling and the engineering of the vehicle fronts. The aim was the protection of the pedestrians, a trade-off between safety and other vehicle performance requirements (i.e. aerodynamics).

Several regulations were introduced for the pedestrian safety, with most prevailing the EC Regulation and the EuroNCAP protocol.

The **EC regulation** sets out the basic requirements for the protection of pedestrians and other vulnerable road users in the form of test procedures and test limit values. These regulations are specific to the type of vehicle (i.e. size, platform) and for the frontal protection systems (i.e. bumper, bonnet) individually.

EuroNcap aims to encourage the improvement of vehicle performance, concerning the pedestrian safety, through leg-form, upper leg-form and child / adult head-form testing.

A: Target point
B: Impact point
θ : Impact angle

ANSA Pedestrian tool

The Pedestrian Tool of ANSA pre-processor enables the user to set up a complete simulation scenario of a pedestrian protection test, according to the EC Regulation and EuroNcap protocols.

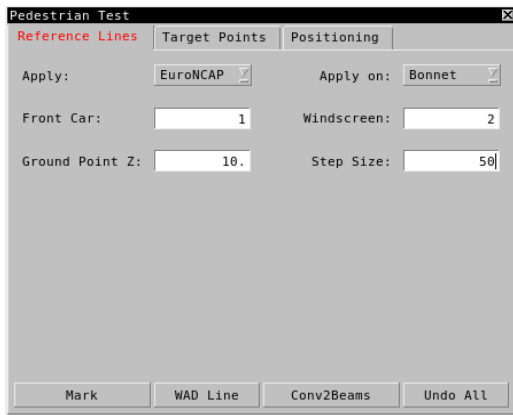The ANSA Pedestrian Tool goes through the following steps:

- Creation of the **Reference Lines**
- Determination of **Target Points**
- **Positioning** of the Headform on the Target Points

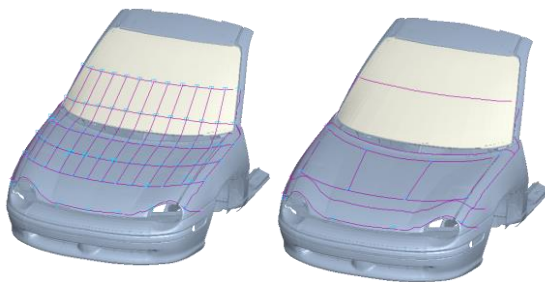The above steps can be applied both on FE-mesh and unmeshed geometric data.

Creation of Reference Lines

Reference Lines

In the Reference Lines tab of the Pedestrian Tool window, the user selects the protocol type (EuroNCAP, EC), selects the part of the vehicle (bonnet, bumper or both) where the lines will be created and defines the height of the ground and the resolution of the curves for the creation of the respective WAD lines.

The EuroNCAP and EC Regulation propose slightly different ways of dividing the front area of the vehicle in crucial sub areas. The difference occurs in the distances that the WAD lines have from the ground in each case.
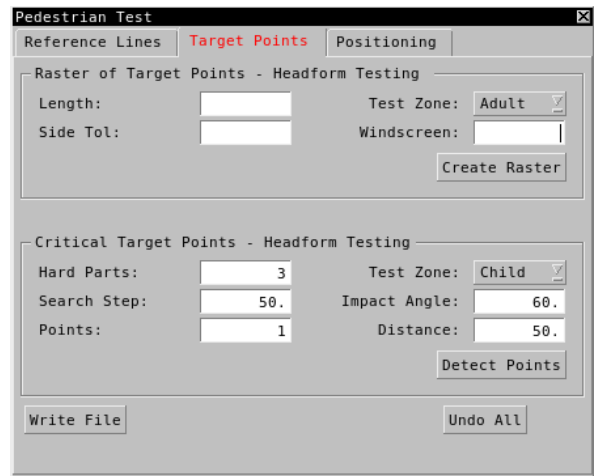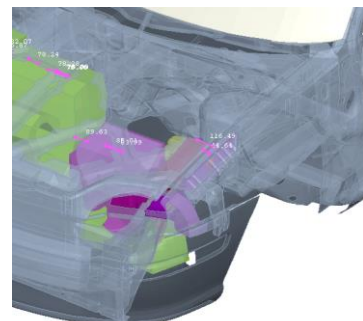

EuroNcap Protocol

EC Regulation

Target Points Determination

The creation of the WAD lines leads the user to the determination of the Target Points. These points illustrate the exact endangered positions for a pedestrian through a crash. The Target Points tab of the Pedestrian Tool window enables the user to determine these points in two different ways: by creating a Raster of Target Points or by direct determination of Critical Target Points. The Critical Target Points are determined by providing a set of entities with the "Hard Parts" such as engine block, battery tray etc.
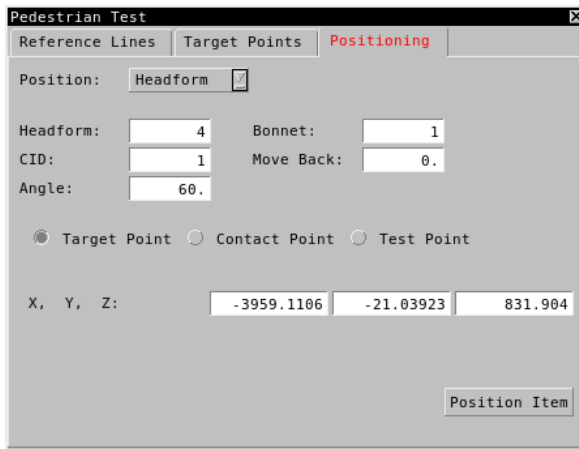

The position of the Raster and the Critical Target Points depends on the selection of the test zone: Child or Adult. The determined positions can be output in ASCII file and the user can use them directly in the post-processing phase with META post processor.

Positioning of Headform

After the determination of the Target Points, the next step is to place the Headform on these locations. The user selects the impact angle of the Headform, picks the target position from screen and executes the function.
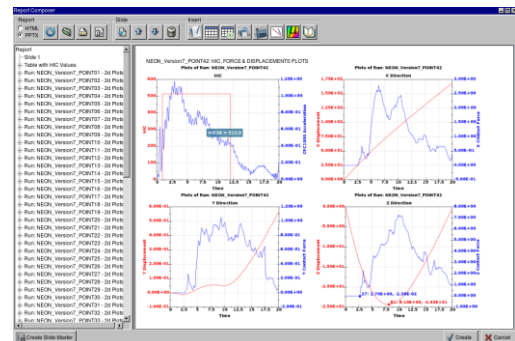

Hit Points Post-Processing

Selection of Hit Points for post-processing

META post-processor offers a user-toolbar specially developed to facilitate the post-processing of pedestrian analysis. All available results are automatically traced and listed in an interface that allows their selection.

2D Post-Processing

The calculation of the HIC criterion of all hit points results files is offered. Then, the software automatically creates an HTML & PPTX report with a summary table and 2d plots of HIC values, displacements and contact forces for each hit point.

3D Post-Processing

Through the 3D post-processing, it is possible to have bonnet deformation visualized according to the maximum deformation from all hit points results, and to append to the generated report a table with the maximum displacements of head and bonnet.
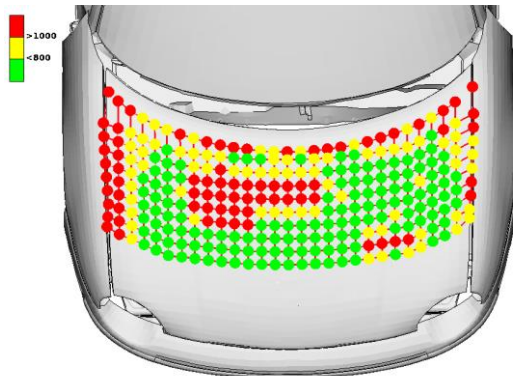
Additionally, .gif videos of the area around each hit during the impact can be generated.
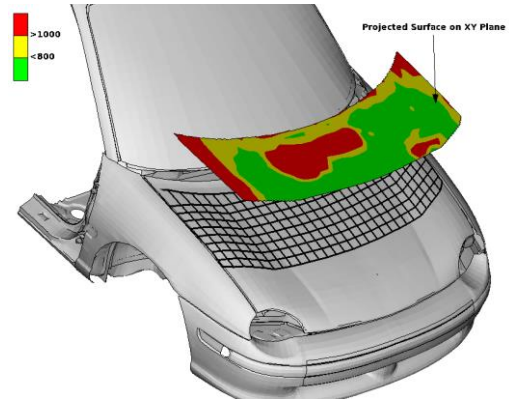
Creation of Annotations

Annotations with HIC values

The user can create value-based colored annotations for the hit points, by reading the ASCII file containing stored results of the 2D post-processing analysis.

Interpolation & Projected Surface

The HIC values can be interpolated on the bonnet model. A projection of the impacted area is automatically created.

The area above a threshold HIC value is calculated, using the created projected area. META variables are also created to store the relevant values.

```
Total Visible Area: 611430.014
Visible Area above 1000: 153410.515
Visible Area above 1000: 25.09 %
execution finished
```

Conclusions - Benefits

ANSA & META suite offers powerful and unique functionality that allows pedestrian safety simulation model setup and analysis under a single roof.

For more information contact
BETA CAE Systems
Email: ansa@beta-cae.com