AUTOMATION OF CAE PRE & POST PROCESSING ACTIVITIES USING ANSA & μETA SCRIPTING CAPABILITIES

[1]Alejandro Palacio[*], [1]Xavier Latorre, [1]Carles Mitjans, [2]Pablo Cruz

[1] IDIADA Automotive Technology S.A.
[2] IDIADA Automotive Technology India Pvt. Ltd.

KEYWORDS – Automation, pre & post processing, scripting, efficiency, quality.

ABSTRACT –

Automation of routine tasks is a demanding and necessary tool to increase productivity and control quality of CAE activities. The latest versions of ANSA and μETA software include scripting language capabilities that allow automation of many of their commands and processes.

The IDIADA CAE department works in different fields of automotive engineering for many clients around the world, performing a wide range of CAE simulations. All these capabilities demand flexible and centralised pre & post processing tools.

A pre-processing tool has been developed for conversions between different types of files, meshing of geometries and reparation of meshes, and works simultaneously with high volumes of files. It includes several scripts that execute ANSA sessions, following mesh criteria and parameters defined specifically by IDIADA engineers for each field of simulation.

In the future, the objective is to integrate this tool as the first step of workflow for both the ANSA Data Base and Task Manager. This phase is already under development, together with new tasks to automate model building and other specific scripts.

Finally, another similar tool has been created to post-process CAE simulations. Post-processed information includes outputting 3D models and curves, comparisons of simulations, storage of curves and images, generation of reports, etc., presented in a corporate and stylish format. This program contains a generic script that, depending on user requirement's, calls independent functions written using the scripting editor of μETA.

The majority of these new tools have been implemented into the work areas of the IDIADA CAE department. Results have shown a considerable time saving and an important reduction of error prompts while performing routine tasks. Furthermore, the learning process of junior engineers is accelerated and a new quality standard has been defined. An important effort is being made to extend automation tools to all areas of CAE within IDIADA.

ACKNOWLEDGEMENTS – Pedro Rubio.

1. INTRODUCTION

The use of routines and scripts to automate tasks is a demanding activity in the world of CAE which has been enhanced exponentially in recent years due to the introduction of new capabilities in pre & post-processing software. The combination of new tools mainly in the area of passive safety that reduce the time necessary to set up simulations and increase the accuracy on geometrical analysis, combined with the utilization of programming languages to program repetitive activities, has modified and increased the added value of the work done by CAE engineers.

IDIADA is a company dedicated to product development in the automotive sector, offering engineering, testing facilities and homologation services to the industry world-wide. The IDIADA Design & Engineering department participates on the phases of Styling, Surfacing, CAD and CAE. It works closely with the company departments of Benchmarking, Concept finding, Prototype Building, Testing, Validation and Homologation. Since CAE is a tool employed in every phase of the global vehicle development process at IDIADA (Concept, Development, Validation), automation of routines has always been necessary to achieve targets and be competitive.

CAE fields of development at IDIADA comprise projects in the following disciplines:

- PASSIVE SAFETY: Crashworthiness, Occupant Protection, Pedestrian Protection.
- STIFFNESS & FATIGUE ANALYSIS: Static, Dynamic, Fatigue, Thermal.
- NVH: Trimmed Body Vibrations, Interior Noise Prediction, Panel Contribution & Sensitivity Analysis.
- VEHICLE DYNAMICS: Suspension, Braking, Steering, Handlings & Stability.
- FLUID DYNAMICS: External aerodynamics, Underhood Thermal Management, Defrost Systems, HVAC.
- COMMERCIAL VEHICLE
- SUPPORT TASKS: Material Characterization, Auxiliary FE Model Validation, CAE methodologies development.

The great variety of projects performed, and the fact of being a service company that works with a wide range of OEMs and suppliers makes it difficult to unify automation tools. A big effort has been done during recent years to update old macros and session files, and improve them with new capabilities implemented in pre & post processing software, like last versions of ANSA & μETA (1,2,3,4).

2. TARGETS AND CONSEQUENCES IN AUTOMATION

The automation of activities is understood by IDIADA as independent processes inside a project development. The goal has never been to automate the full process, from CAD files to final reports that summarize results from the simulations. A strict control of all the tasks and processes performed by the CAE engineers is necessary to certify the quality standard and to be sure that no errors have been made. For that reason, all automation tools developed are separated inside pre-processing and post-processing activities.

This paper resumes the work performed over recent years in the IDIADA Design & Engineering department in the development of a multi-user virtual environment, named eMAP (*environment for Management of Automated Processes*), that includes tools related to automated tasks during CAE models development, and analysis of results from simulations. This tool employs macros and scripts written using ANSA & μETA commands. Tasks included on this tool are subdivided into two main groups: pre-processing tasks (called eMESH) and post-processing tasks (called ePOST). In order to improve productivity, assure the standard of quality desired and remove errors during the interaction between man and machine, all macros and scripts have been revised and improved during recent months, and new tools have been developed to fulfil new department and client requirements. Another efficient tool employed on the set up of CAE simulations is based on the ANSA Task Manager. However, since the potential of this tool has not already been totally explored, and most of the simulations performed at IDIADA require that engineers manually control all the set up process, it has not yet been included into the eMAP environment. Consequently its application to a very specific work case is analyzed separately.

The innovative aspect of this tool is that automates a group of tasks that historically have been performed manually, and require extensive human and time resources. A great part of work routinely carried out in CAE activities is now performed automatically and supervised by engineers, thereby increasing efficiency. Traditional workflow in CAE activities is shown in Figure 1:

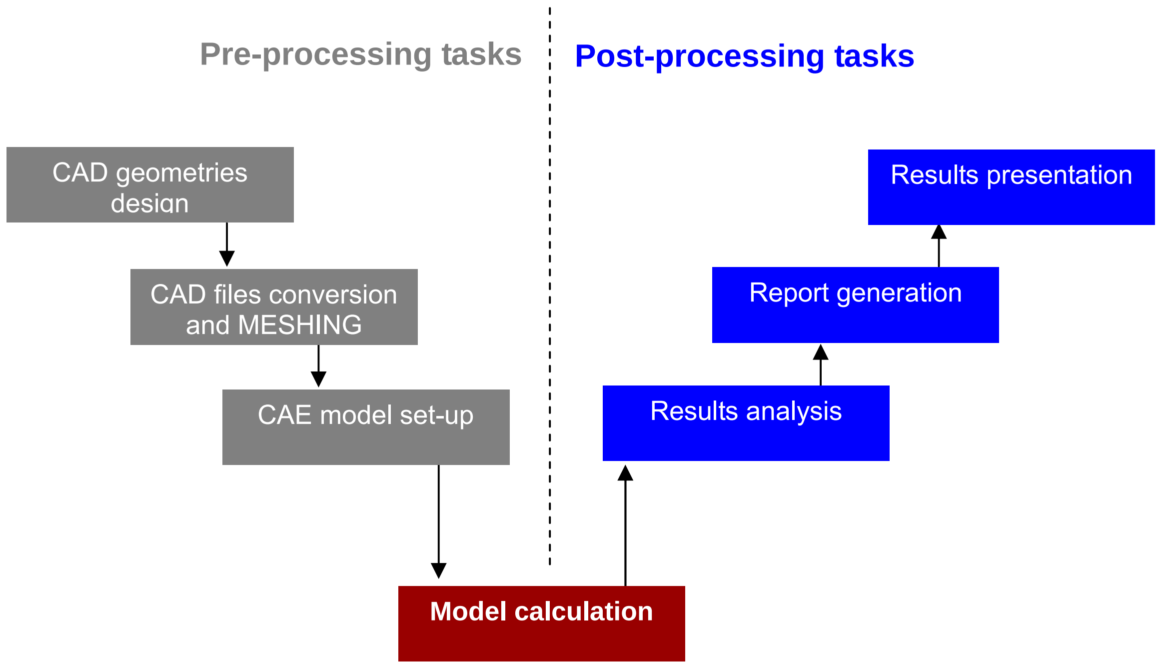


Figure 1 – Traditional workflow followed during CAE activities.

The tool described on this project has changed the workflow as shown in Figure 2.

The new application is being used to convert CAD files and mesh geometries, obtaining model parts already customized for the CAE model set up. Also, once the simulation has finished eMAP plots curves, stores graphs and images and generates the corresponding reports according to the type of simulation performed, the client and the regulation that must be fulfilled.

In conclusion, engineer tasks are more focused on analysing and error checking than on routine processes. Furthermore, the application is very flexible and easily updated if new releases of the software come out, new scripts are developed or new types of simulations need to be post-processed.

3. PRE-PROCESSING ACTIVITIES

Automated pre-processing tools actually fully developed at the IDIADA Design & Engineering Department are separated in three groups, which will be described separately in this section: eMESH regarding CAD files treatment and meshing, Occupant and Pedestrian Protection tools, and the application of the ANSA Task Manager to a very specific work case.

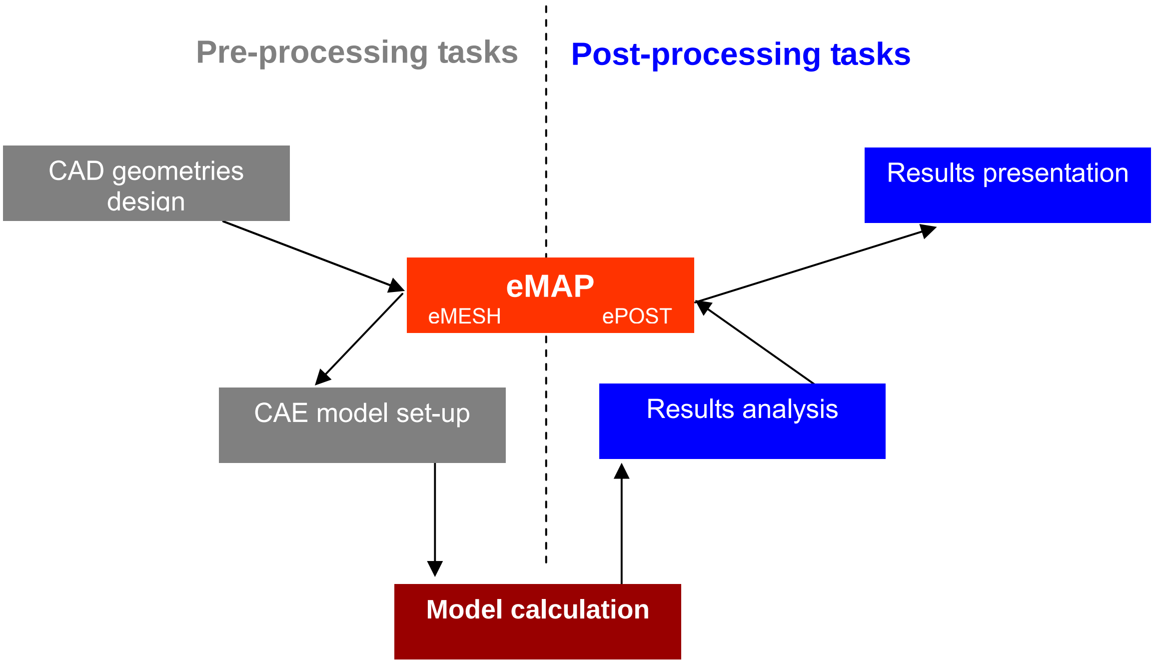


Figure 2 – Current workflow followed in the IDIADA Design & Engineering department.

eMESH

One of the main activities within CAE pre-processing is related to geometry treatment and meshing. The establishment of a good quality mesh is considered crucial in order to obtain accurate results in simulations. It comprises several steps from removing and correction of imperfections from the geometry, creation of macro areas that follow as accurately as possible the geometry surfaces and finally, meshing the macros fulfilling the corresponding mesh criteria. This job requires a long time and a big human effort depending on the dimensions of the geometry. eMESH is a tool developed at IDIADA based on ANSA, that allows a fast and efficient conversion between different types of files, meshing of geometries and mesh repairing, reducing the time employed for this activities, and the errors produced. As a consequence, the work of the user is reduced to checking the quality of the mesh obtained.

eMESH is constituted by a group of script files that execute session files specifically designed which include ANSA commands. It is built through interactive menus that allow an easy access to the different tools by the user. The main advantage is that it permits working with groups of files (folders that include many CAD files) rather than with simple files, accelerating the mesh treatment when working with big quantities of geometries. It is also very fast in obtaining good quality meshes in a few minutes, increasing the productivity and efficiency in mesh activities. Finally, eMESH helps in reducing possible human errors produced due to the manual and repetitive activities of meshing, so improving the quality of the work performed.

The standard workflow for meshing activities followed using eMESH is summarized in Figure 3.

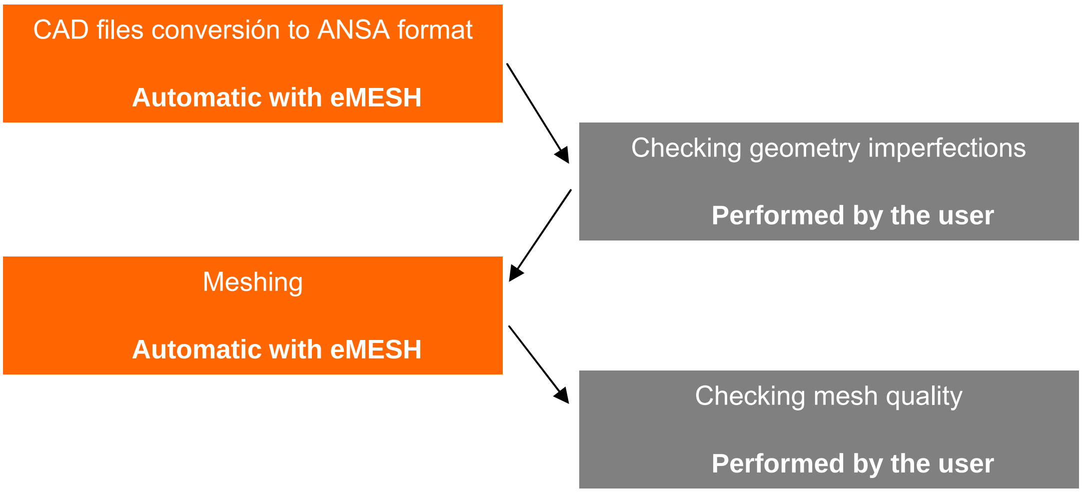


Figure 3 – Standard workflow for meshing activities followed using eMESH.

The first step required before meshing geometries is the conversion of files to be easily treated by ANSA. For this purpose, eMESH allows the conversion of a folder with CAD files (.catparts, c.model) into a folder with ANSA files. eMESH allows also the opposite conversion, it means from a folder with ANSA files into a folder with CAD files (.igs), to be further treated using CAD software.

Once the geometry is converted, a second menu includes different tools for meshing.

1) *Batchmesh meshing*: it performs a fast meshing of the geometry. It must not include ribs.

2) *Script meshing*: the option most employed. It performs a better quality meshing, and in this case the geometry can include ribs. It is slower but very effective.

3) *Fast script*: employed for passive safety positioning operations and for CFD meshing.

Finally, another menu include tools to simplify frequently used operations performed during meshing like re-meshing applying different mesh criteria, .stl files checking for CFD simulations, converting and meshing volumetric geometries (with thickness) into shells using the ANSA “skin” option, etc.

The structure of eMESH is built through two different types of files:

- *mesh criteria files*: include the ANSA.defaults, the quality criteria (mesh length, warping, aspect ratio, skewness...) and the parameters (holes, fillets, flanges...) necessary for the mesh definition. IDIADA has established different mesh criteria files appropriate for the different fields of work involved.

- *macro sessions* that execute ANSA commands and perform the different tools previously described.

These files are linked through a main input file which is used as an interactive menu where the user chooses the desired tool and mesh criteria, and introduces the information requested. It automatically defines the variables to be transmitted to the macro sessions. The keyword to obtain good results using e-MESH is to maintain a consistency between the mesh criteria selected and the size of the mesh.

As shown in Figure 1, eMESH automates a lot of routinely operations with great results. However, input and output files must be carefully checked, analyzed and corrected by the user. It is necessary to dedicate some time for geometry treatment and to decide which face will be meshed (inner or outer), or create the corresponding middle surface. It is also important to have a good connection of all the surfaces where the ribs exist, and they must be properly connected. In addition, after the use of eMESH some work is required in order to improve the quality, such as reducing the concentration of 'triads' or modifying the mesh in small areas located near connections, boundary conditions, loads, etc..

Occupant and Pedestrian Protection tools

Most of the improvements made in this field have been carried out by pre-processing software developers. Last versions of ANSA (1,2) include a module that allows an easy manipulation of dummies. This tool is widely used by IDIADA engineers when trying improvements and modifications in the position of the dummy in the car, or when new geometries of the vehicle interior or new versions of restraint systems are released during the development of the project. By applying a few simple orders it is possible to set up a hierarchy within the dummy parts and joints, to translate it into the vehicle and rotate their limbs to reach an adequate and fast positioning. Furthermore, adaptation of seat belt webbing geometry to the new dummy positions is easy thanks to the dummy seat belt definition tool.

A big effort has been made by ANSA from release 13.0.1 (2) in pedestrian protection. This new tool will be used to set up pedestrian simulations based on the Euro NCAP Pedestrian Testing protocol (5) and ECE 78/2009 regulation (8), including definition of pedestrian protection areas based on hard surfaces and positioning of headforms and legforms. Since this new tool is considered under evaluation, all the process must be strictly

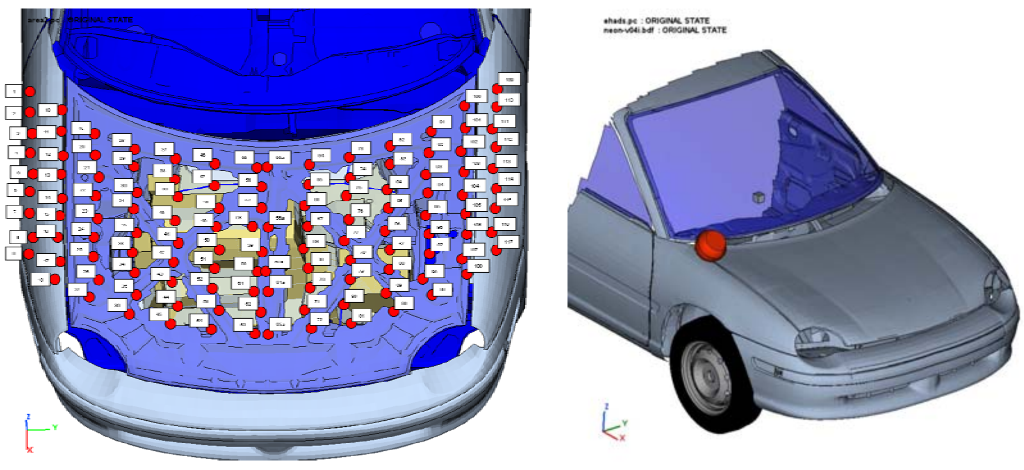


Figure 4 – Pedestrain analysis (headform impact) for a new bonnet geometry: impact locations.

controlled by the engineers because results are not yet as accurate as with other pre-processor software currently in use at IDIADA. Without any of these tools, this process requires a long time to be performed and to check that no errors are made.

A status of pedestrian analysis (headform impact) for a new bonnet geometry requires approximately 80 impact points (Figure 4). This process without support of any automated routine takes a long time to be performed, and errors can easily be produced. The combination of pre-processors pedestrian protection tools for impactable areas definition, together with script files specifically designed for this task has enormously increased productivity and quality at IDIADA in the last years. The analysis starts saving the vehicle under one single include file. Each target point has associated a bonnet node renumbered coherently to the target point. To better identify them, neglected masses are added to these nodes. Then, a list with bonnet nodes corresponding to impact points is required by the pre-processor software to position the headform, and to save an include file with the corresponding headform translations for each impact point. A script file written in bash language creates the folders for each impact point (each folder named equal to the bonnet node) and introduces the necessary include files for the simulations: the vehicle, the head, and the corresponding transformation. Finally, another script starts every simulation sequentially.

A similar analysis is performed for legform impacts, and equivalent script files for model set up have been created at IDIADA according to the different regulations.

Finally IDIADA employs another powerful software tool for FMVSS201u (10) analysis. This regulation identifies several impact points on the upper interior of vehicles that later must be impacted by a headform (Figure 5). With a simple definition of the geometries PIDs that constitute interior, exterior and vehicle pillars, the tool automatically calculates the impact points with great accuracy. It also facilitates the re-calculation of the target points

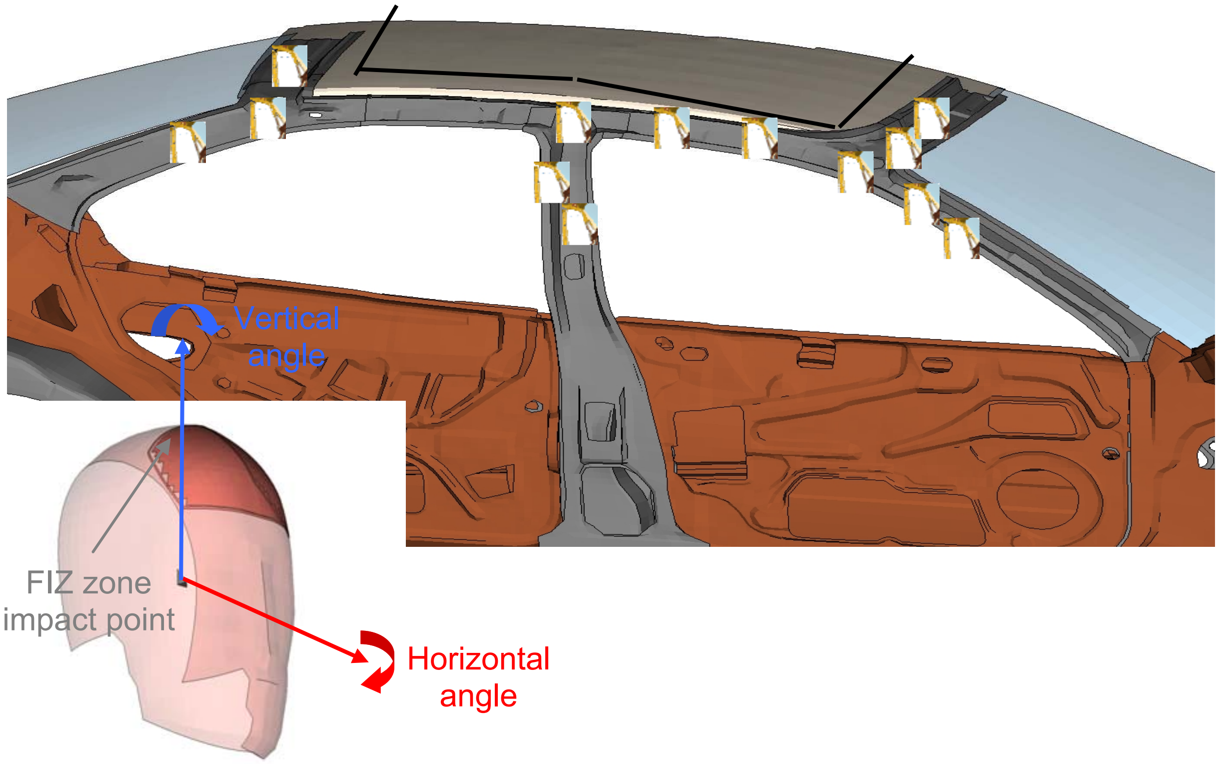


Figure 5 – FMVSS 201u analysis: impact locations and parameters to control for headform positioning

when new geometries of the car are released. The software also includes automate and manual positioning tool for the headform. Due to the long experience reached by IDIADA in testing and simulation according to this regulation, this process is performed combining the automatic and manual tools, since there are many parameters to control during the positioning, and every positioning must be deeply evaluated by engineers.

Task Manager

The ANSA Task Manager allows work automation and improvement of the quality of model preparation. These functions are not totally implemented yet, but it allows us to start thinking about a new working philosophy.

Together with Task Manager, it is necessary to work use the ANSA Data Base (organised as a directory structure) where all files used in the model definition are stored. Inside the Data Base all files are saved in an organised way by ANSA, allowing an easy access from the working area (geometry folders, welding point folders…..). It is important how the stored geometry is treated. This is based on different CAD geometry versions, and also different mesh versions and proposals for each part. Using the Data Base we can control the evolution of parts and groups, using different meshes related to the kind of simulation, everything under a folder structure and easy to change between them.

Using Task Manager is necessary to define all the tasks as a tree, from the input of the geometry/mesh up to the output of the calculation file. All tasks defined could be ANSA instructions, predefined tasks or ANSA scripts created in order to concatenate different individual tasks as a package.

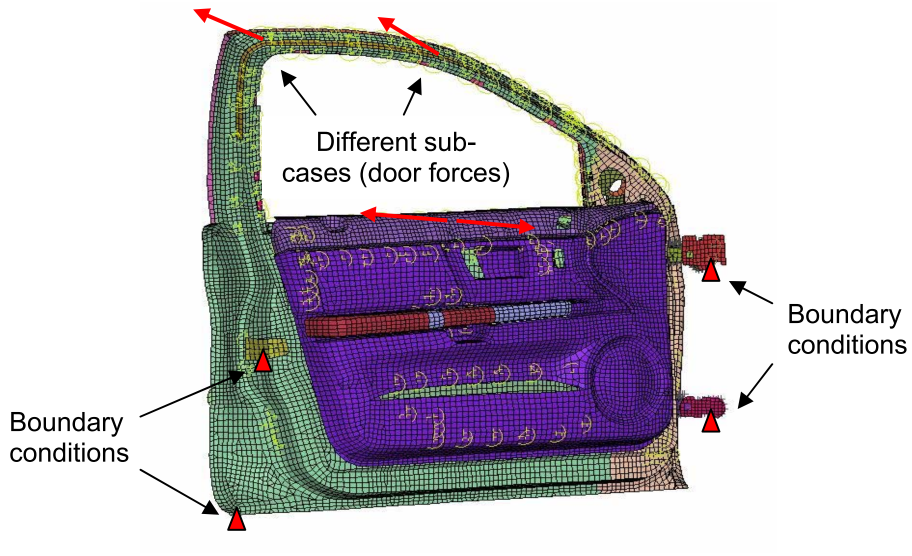


Figure 6 – Example of application of the ANSA Task Manager to the simulation set up of a door.

To work in an efficient way, it is necessary to combine the Data Base and the Task Manager. In the Data Base we have all CAD versions for each part, and also all their mesh representations. It can be easy to exchange one representation / version by another. In the Task Manager we can make a fast setup starting from a predefined task. Having all the work information in the Data Base structure and creating different Tasks in ANSA Task Manager for each kind of simulation, it is easy to associate both and realize some studies easily and having the same standard of quality.

The main problem of ANSA Data Base is the time necessary to prepare all the information in the right format, and organise it in the folder structure to be used in the Task Manager. For this reason, the use of Task Manager will be reduced to big projects with a large number of simulations and where a lot of different geometries and modifications exist. Task Manager will also be useful in local studies of different groups like static analysis of mobile parts of the car (doors, bonnet, tailgate…), where the amount of information is not too big (Figure 6). All static cases of mobile parts have been performed using Task Manager.

Regarding big models, they are still under investigation. Full crash simulations are under study, working in some scripts that can be useful for explicit codes like PAMCRASH, LS-Dyna and RADIOSS together. In this way, a script has been developed to introduce all welding points, lines and adhesives to a new mesh, and automatically realize all of them at the same time. This script has been tested in an offset crash. The mesh representation has been changed (all organised in the Data Base), and the offset prepared again (using the Task Manager), realizing all the welding points in the new model (running a script in the Task Manager).

4. POST-PROCESSING ACTIVITIES

Automated post-processing tools for simulation comprise animation showing, graph plotting, curve and picture storing, and report elaboration: These reports are employed in two ways, for analysis at IDIADA and to be sent to clients, always in a stylish corporate format. These tasks require lot of time spent on routine activities and most of the time each engineer creates his or her own report losing the corporate uniformity. One of the targets found with the automation of post-processing activities is to include all macros and sessions, developed for each field of simulation and for each of the tasks mentioned above, in a centralized application in order to increase productivity, quality and uniformity, and finally reduce post-processing tasks to the one considered with most added value: analysis of results by the engineer. The application within eMAP that integrates all these macros is called ePOST.

Up to now, ePOST has been fully developed to post-process results from the following fields of simulation: Occupant Protection and Pedestrian Analysis.

Occupant Protection

One of the major areas of work within the IDIADA Design & Engineering department is the integration of the different restraint systems (airbags, seat belts, seats) in the vehicle for occupant protection. All these elements must be coordinated to act simultaneously during a car collision, and restrain the dummy before and during the impact to reduce the severity of injuries suffered. The IDIADA Crash Test laboratory generates official reports of each crash test performed, including curves, injury values and assessment values following the guidelines of the different regulations (ECE, FMVSS, etc.) and commercial assessments (Euro NCAP, USNCAP, JPNCAP etc.). Usually these reports are also provided to clients. Working in parallel, the IDIADA Design & Engineering department performs crash simulations and all dummy and vehicle sensor values need to be output in different media, for analysis by IDIADA's engineers, and later provided to the client.

The scripting tool recently available in μETA (3,4) allows the combination of all μETA commands with programming capabilities. Furthermore, the use of simple *bash* command syntax to create interactive menus (shells) where the user can choose between the post-processing options, enhances the automation capabilities of μETA.

This group of tools are employed at the IDIADA Design & Engineering department to post-process restraint systems simulations, and generate the following information:

- Opening of μETA Post-Processor showing results (3D models, plots) of simple simulations, or the comparison of several simulations, or the correlation of a simulation with real lab tests.
- Storing plots and images in different formats (.ascii, .jpeg). Taking pictures automatically of the simulations during critical moments and getting their

corresponding forces, accelerations and injury values. All this information is later employed in the preparation of summary reports.
- Preparation of several types of reports (.html, .ppt, .pdf) for internal use, or to be sent to clients, following a stylish corporate format.
- Summarize all the calculations performed for a project including the most relevant information (name, author, previous model, modifications, maximum and minimum values). This list is automatically updated every time a new simulation is post-processed.

This system has been built to be employed by the user in the following manner: the first step after a simulation has finished consists of its simple post-processing. All plots and pictures are stored into the simulation directory. A standard report is created and the project simulation list is updated. During a second phase, the user frequently needs to compare a simulation with another one or with test results from the laboratory. In this case, the values previously stored are opened by μETA and plotted on screen, and saved again if desired by the user.

The design and operation of the system consists of the successive execution of several script files written using bash language, μETA scripting language and μETA session commands. Arguments and variables are passed through each other. A description of the main four files in the order they are executed is given below:

1) A **shell** script written in *bash* language is used as the interface between the user and μETA. A simple menu asks users what types of simulations they want to post-process: frontal crash, side crash, 'kneemapping', etc.; what kind of regulation or commercial assessments to follow to establish the guidelines (ECE, Euro NCAP, FMVSS, etc.); what method of post-processing to execute: a simple simulation, a comparison between two of them, or a comparison with results from testing; and the path where the simulation is located. More information is requested via this shell such as the position of the dummy in the vehicle, the name of the impact point for 'kneemapping' assessment, etc. All this data is stored via *arguments* that are passed to *session files* which are executed in μETA. A folder with several subfolders is created in the simulation directory to orderly save all the information that will be post-processed.

2) A text file called **'numbering file'** is created for every new project. This file contains information necessary for the post-processing of the simulation and for the preparation of reports that will remain invariable during the development of the project. This file must be filled in by the project manager before performing any simulation. This information includes the nodes numbers for the dummy and vehicle sensors, the groups of PIDs that will be painted with the same colour and those colour names, the output frequency of the simulation states and project information such as project name and code, client name, client responsible, project manager, project path, etc. A different 'numbering file' is needed for each dummy position.

3) A **session file** using sequences of standard μETA commands is necessary for each method of post-processing. This session file performs three different tasks: firstly, read and stores the *arguments* passed by the *shell script* in μETA *variables*. Secondly, calls the individual *script files* via *functions*. Finally, removes temporary files created during all the process.

4) Finally, the system is constituted by several **script files** written using a combination of μETA scripting language (commands similar to the C programming language) and μETA commands. Each *script file* performs a different task. They are completely

independent so can be fast and simply modified, and new scripts can be created if required to perform new tasks. The script which is always first executed is that called 'Data Acquisition'. It reads all the lines in the 'numbering file' and stores the information in μETA variables. The rest of scripts open the CAE output files and plot the curves, establish the regulation guidelines, calculate injury values, write plots and images, colour the CAE model, create the reports and update the list simulation file.

All these files are stored together with *html templates* of the sheets that compound the different reports, and *views* saved in μETA to take specific pictures. The only files that need to be edited by the users (once per project) are the 'numbering files'. Figure 7 represents an example of two of the sheets that constitute a 'kneemapping' assessment report, and Figure 8 the equivalent for a side crash report, both following Euro NCAP protocols (6, 7).

The system is easily adaptable to every kind of CAE solver employed (PAMCRASH, LS-Dyna, ABAQUS, RADIOSS, etc.).

<u>Pedestrian Protection</u>

As mentioned in the pre-processing section, a status of headform pedestrian analysis for a new bonnet geometry requires approximately 80 points to be studied. It also requires a powerful tool to automatically create reports with results from the simulations. In the same way, two different script files written in bash language, μETA scripting language and μETA session commands have been created to post-process these results. Reports are created using .html format and designed according to the following structure:

a) A global index summarizes all the geometries and regulations analyzed for a vehicle. Each of them is equivalent to one status.

b) Each status is analyzed in a page showing a picture of the bonnet with all the impact points (their names and colours depending on the impact severity) and a list with all the impact points and their corresponding HIC values (Figure 9).

c) Finally each of the simulations that constitute one status show graphs with the acceleration vs. time, displacement vs. time and acceleration vs. displacement, together with a picture of the impact location. Another page includes cutting sections showing the head and the vehicle during the impact (Figure 10).

All these .html reports are linked each other to allow a fast access.

The first script requires the list with all the impacts performed to execute the macros that create every single report for each impact point. This first step could be improved to be executed automatically after running the solver. The second script writes de HIC values calculated in the first step applying different colours according to the impact severity. Finally, it paints the impact point on the bonnet with those colours, and when the post-process is done following regulation ECE R78/2009 (8), the software exports the impactable area which has a HIC performance less than 1000 (it is considered A-Area) and the impactable area which has a HIC performance less than 1700 (it is considered B-Area) [5,6] as CAE input files. For determination of A and B areas, the percentage of surface is needed.

The same analysis is performed when studying legform impacts.

All the .html reports are later sent to the client for analysis. An example of the time saved using these routines is that one geometrical status of 80 simulations can be post-processed by one single CPU in one hour and a half, almost entirely without the participation of any person. In the past, 2 people were required full-time for two weeks for the same type of analysis.

SUMMARY KNEEMAPPING VALUES

Applus® IDIADA — BETA CAE Systems SA

model_A

Driver• Left Leg• Right Leg• • Femur compression [kN]• -0.27• -3.21• • Knee slider [mm]• -0.92• -3.82• •

model_B

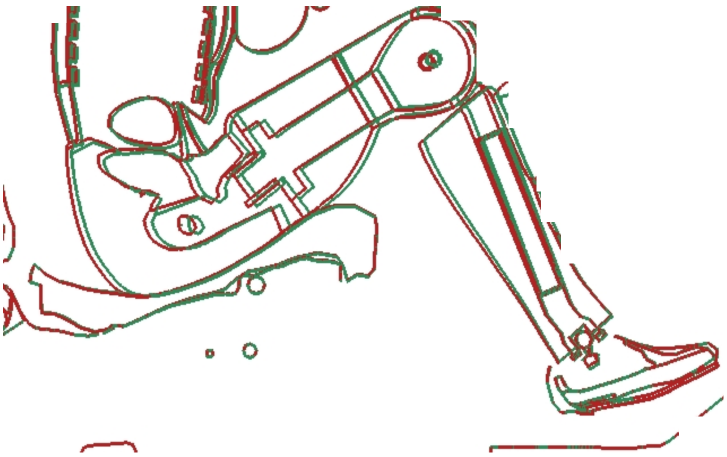
Driver• Left Leg• Right Leg• • Femur compression [kN]• -0.52• -3.15• • Knee slider [mm]• -0.10• -4.00• •

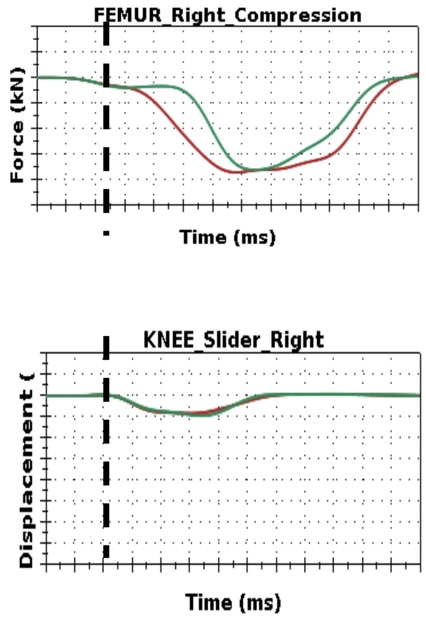
	Femur compression [kN]	Knee slider [mm]
(red)	Fz<-3,8	s>6.0
(yellow)	-3.8≤Fz≤-3.0	4,8≤s≤6.0
(green)	Fz>-3.0	s>4,8
(blue)	Not evaluated	Not evaluated

BASE: model_A
MODIFIED: model_B
Vehicle type: sedan
Dummy type: HybridIII 95%
Test type: KNEEMAPPING
Position: Driver
Date: 11/09/2009

MAXIMUM FEMUR FORCE

Applus® IDIADA — BETA CAE Systems SA





BASE: model_A
MODIFIED: model_B
Vehicle type: sedan
Dummy type: HybridIII 95%
Test type: KNEEMAPPING
Position: Driver
Date: 11/09/2009

Figure 7 – Example of two sheets corresponding to a post-processing report for a 'kneemapping' assessment, comparing two different simulations.

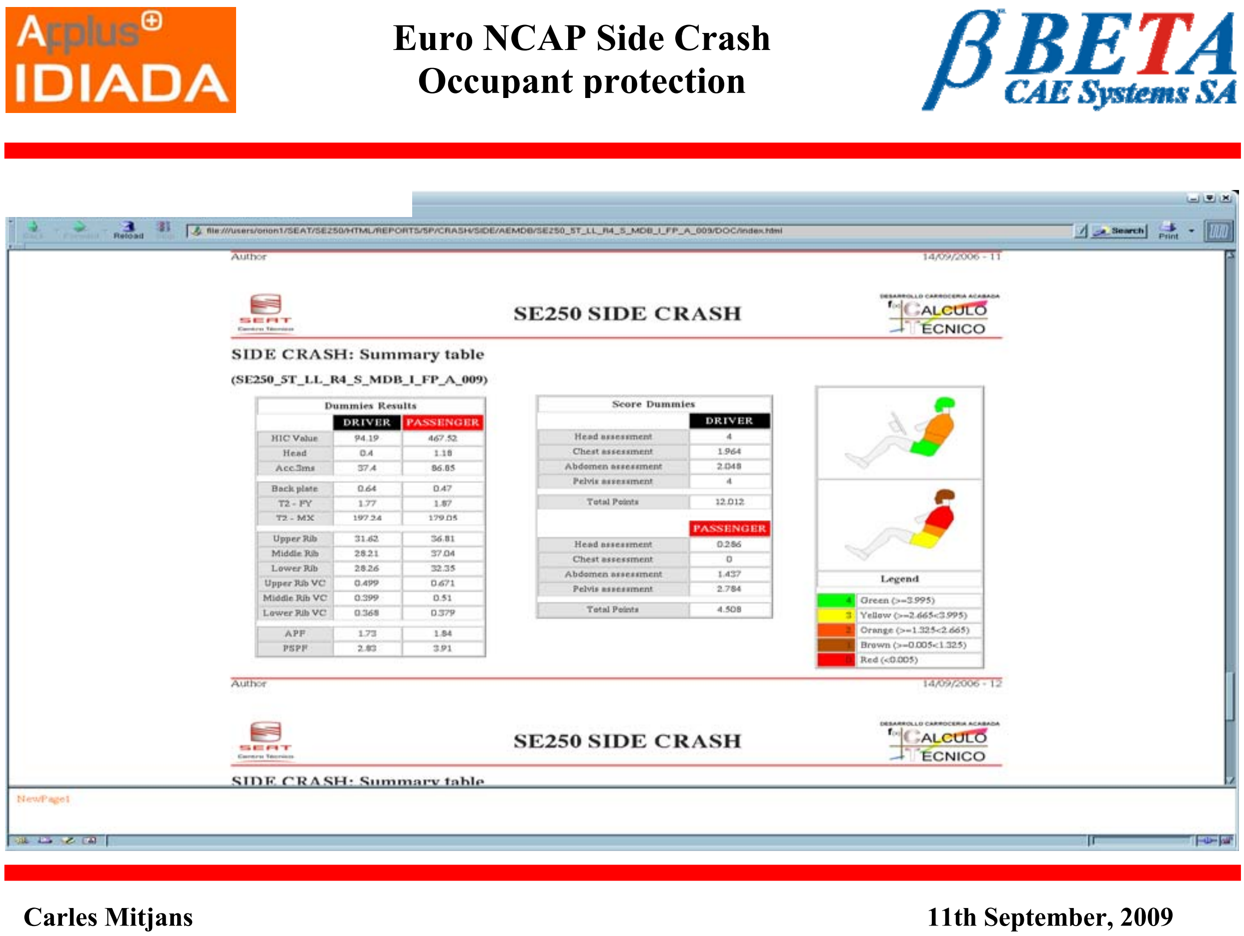


Figure 8 – Example one sheet corresponding to a post-processing report for a side crash assessment, according to Euro NCAP protocol.

Summary table results: Base Line

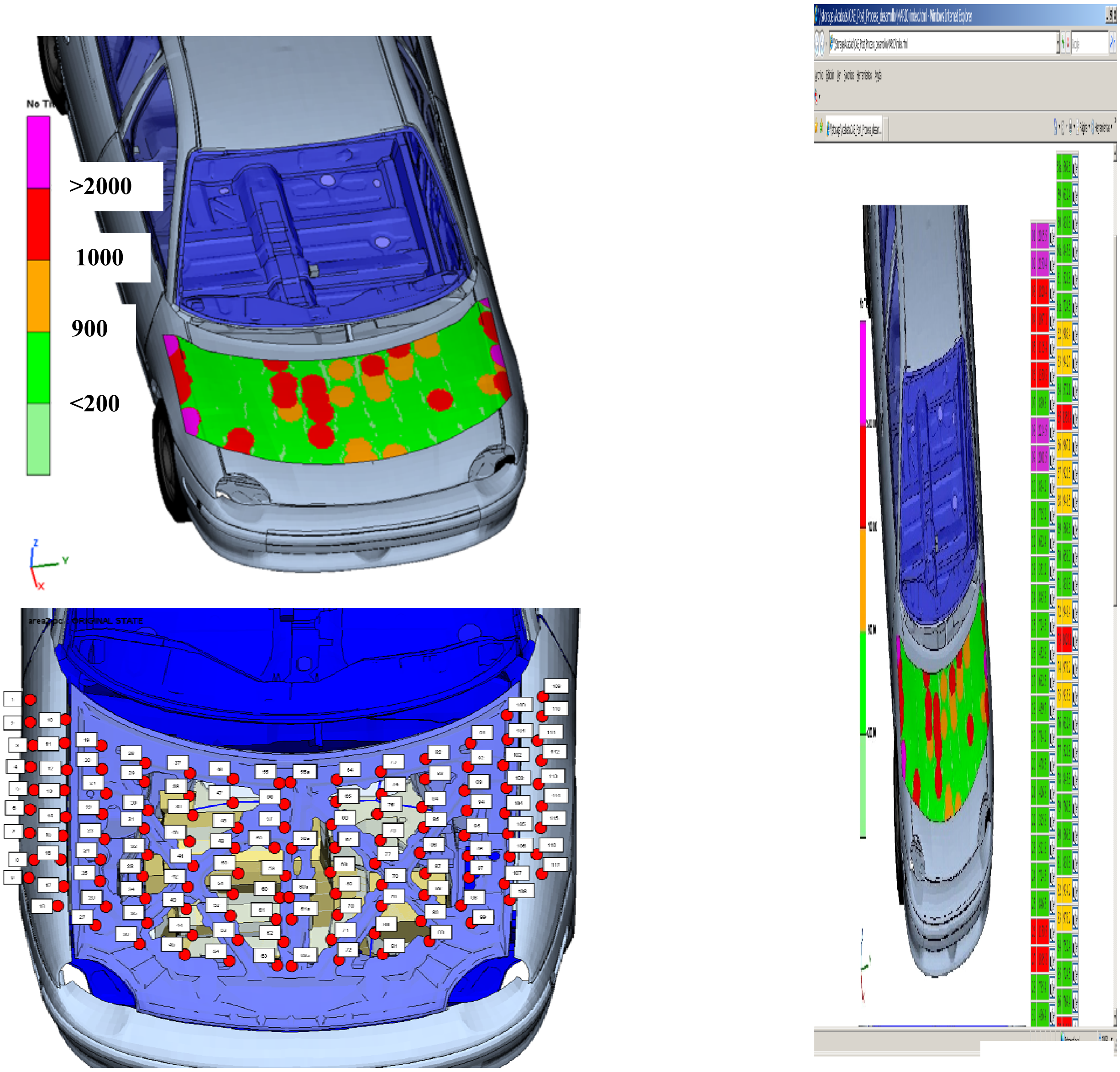


Figure 9 – Example of a post-processing report of a geometrical bonnet status for pedestrian protection (headform impact).

Figure 10 – Example of post-processing report curves of a single impact point, within a geometrical bonnet status for pedestrian protection (headform impact).

Finally, it is important to mention that IDIADA has made a big effort in the development of macros and scripts regarding structural analysis. However, they have not been yet included into ePOST, and that is the reason why they have not been described on this paper.

5. CONCLUSIONS

This paper summarizes the effort carried out during recent years by the IDIADA Design & Engineering department on the use of tools available on current pre and post-processing software together with knowledge about computer programming languages, to automate CAE activities. Three different results were obtained:

1) New pre-processing tools designed for pedestrian and occupant protection analysis, still under development by ANSA and already available in other pre-processing software, have been studied and integrated as part of CAE activities.

2) A multi-user virtual environment, named eMAP, has been developed to integrate all the 'know how' about automation of processes. This application makes use of new scripting capabilities available in ANSA and μETA combined with knowledge about programming languages, to automate processes of CAD files conversion, meshing, results pos-processing and report elaboration, following guidelines establish at the department for different fields of simulation.

3) The Task Manager is still under investigation. It is considered useful to compare results of simulation from components, but not full vehicle simulations. It is absolutely necessary to use the Data Base and have a good organisation of the information.

Direct benefits after the application of automated tools to perform routine tasks is a considerable time saving during simulation set up, analysis and report preparation processes. This is translated into an increase of the quality of the work performed since more resources are dedicated to the analysis, evaluation and problem solving of the project by engineers.

Automation tools also increase the learning process of young engineers. Firstly, they participate on the development process of the tools, learning the capabilities and bearing in mind the concepts of time saving and quality from the early stage of their learning period. Secondly, once this period has finished automation allows them to focus on analysis and problem solving rather than investing time in routine activities.

Finally it is important to mention that the fact the velocity of CAE processes and tasks is increased, is a consequence but not a target. It certifies the quality of the work done in a more efficient way.

Future work in this field includes support for software developers and analysis of the tools developed for pre-processing activities regarding pedestrian and occupant protection analysis. The idea is to improve the design and features of these tools and the number of automated tasks performed. For example, improvements should be made by software developers to accelerate and simplify the process of introducing small changes in the position of the dummy in the vehicle: the seat belt and the seat foam should readapt their meshes automatically to the new position, avoiding the tedious task of removing penetrations each time. Furthermore new efforts are being made to extend eMAP post-processes to other fields of simulations performed at IDIADA, and to assure that standards of quality desired by IDIADA and required by their clients, are always fulfilled.

REFERENCES

(1) ANSA version 12.1.6 User's Guide, BETA CAE Systems S.A., July 2008.

(2) ANSA version 13.0.1 User's Guide, BETA CAE Systems S.A., May 2009.

(3) μETA PostProcessor version 6.2.0. User's Guide, BETA CAE Systems S.A., June 2008.

(4) μETA PostProcessor version 6.2.1. Scripting Language, BETA CAE Systems S.A., June 2008.

(5) Euro NCAP Pedestrian Testing Protocol v4.3, February, 2009.

(6) Euro NCAP Sled Test Procedure for Assessing Knee Impact Areas v2.5, February, 2009.

(7) Euro NCAP Side Impact Testing Protocol v4.2, May, 2004.

(8) Regulation (EC) No 78/2009 of the European Parliament and of the Council, 14th January, 2009.

(9) Pedestrian Protection European Directive 2003/102/EC of the European Parliament and of the Council, 23th December 2003.

(10) National Highway Traffic Safety Administration (NHTSA), Standard No. 201; Occupant protection in interior impact, September, 2007.