Passion for Safety and Aesthetics

_____ The interior is equally important to the overall impression created by the new Cayman. The interior's design focuses not only on appearance and styling, but also on functional development requirements according to FMVSS 201u.

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Ensuring passive vehicle safety in the "greenhouse area" plays an important role when designing the vehicle interior.

Strategic orientation

As part of the functional development of the vehicle interior, the U.S. law FMVSS 201u plays a central role. This law is an important factor in ensuring passive vehicle safety and focuses in particular on head impact protection in the "greenhouse area"—the area above the top of the door panel that is delimited by the windows, the vehicle roof, and generally the A-, B-, and C-pillars.

Development process for the Cayman

The project work began as soon as the first package concepts were initiated. Early inclusion in the vehicle development process beginning in the concept phase proved highly beneficial. This made it possible to coordinate directly and efficiently in the intricate development process with the various interface partners such as vehicle safety, interior, package, and styling. For example, deliberations regarding the design were aided by design sketches that already included provisions for deformation to enable compliance with FMVSS 201u requirements as well as other package requirements.

Definition of the areas of deformation was coordinated closely with vehicle safety. The objective was to achieve the optimal combination of cost-effectiveness, styling, variant diversity, and lightweight design while fulfilling safety requirements. Deformation elements were designed to comply with FMVSS 201u while considering other aspects such as cost and weight. Free Motion Headform (FMH) calculations were utilized in order to optimize the functional behavior. To conduct the development process without pre-prototypes, the high number of FMH test constellations makes use of the finite element method (FEM) indispensable.

The initial FMH calculation model was based upon the virtual pre-prototype. The FEM calculation was necessary in order to further develop and confirm the deformation concept prior to design-release. Continuous coordination between FEM calculations and component layout helped to ensure an optimal design for the greenhouse area, with little need for additional design changes.

Comparison of test results with the calculations revealed no major deviations—proof of the quality of the function-based design and the calculation model.

Test results from the prototype phase are one of the primary bases for series development. Based on results from crash tests, head impact tests, system tests (such as alternating climate tests) of the complete vehicle, and individual component tests, adjustments continue to be made before settling on the final styling. One particular challenge proved to be the integration of the sun visor, which was only made possible by an innovative deformation concept. Cross-departmental cooperation was exceptionally efficient in this regard.

Optimization through automatic processes

Beyond the success of the project itself, it also resulted in optimizations of development processes that have already benefited subsequent projects. Efficiency was improved through an end-to-end FEM calculation process that includes every step from model construction through analysis. An automated evaluation tool reduces analysis time and improves comparability.

An automated tool for determining the test points and test ranges, stipulated by FMVSS 201u, was developed as well. Immediate creation in the CAD environment saved intermediate steps that had previously been necessary and improved the documentation process, which also resulted in significant time savings. ■