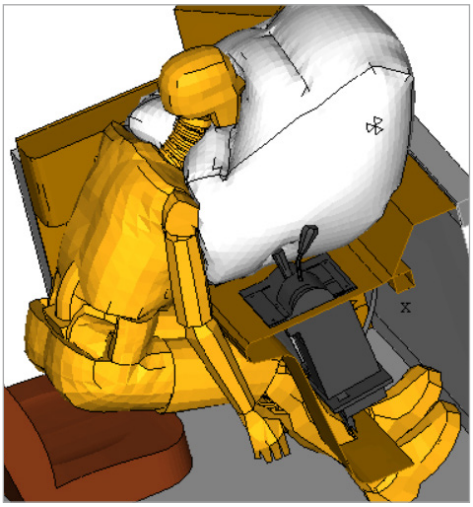
Case Study

Sharma & Associates

Developing an Innovative New Safety Systems for Rail Vehicles

Sharma & Associates (SA), a Chicago-based consulting firm that is focused on providing engineering solutions to the railroad industry, led the effort. Since 1995, SA have delivered safe, effective and efficient solutions to its customers, which include the Federal Railroad Administration (FRA), the Association of American Railroads (AAR), railroads and transit agencies, rail car builders and rail car component manufacturers. The objective of the Altair ProductDesign team effort was to develop an 'Engineer Protection System (EPS)' that can protect train crew in frontal collisions (a common mode of train collision) from secondary impact injuries.



Solution

Altair ProductDesign first created an accurate finite element (FE) model of the interior of a standard rail operators cabin which the team did using HyperWorks pre-processor, HyperMesh. Next, the team brought in a human ATD (anthropomorphic test device) model into the environment and positioned it into the engineer's seat facing the control panel. Altair ProductDesign's crash specialists were then able to experiment with a wide variety of airbag types, sizes, positioning and flow rates, along with developing a new deformable knee bolster to absorb impact forces during a crash.

Result

The first test revealed that the virtual model built by Altair ProductDesign accurately predicted trends and ATD response was around 75%-85% accurate compared to the physical crash result for the most critical injury responses with some minor variations in kinematics of the ATD, an impressive level of accuracy for a first test. Using these results allowed the team to make some minor improvements to the models to better correlate the analytical performance model to the physical testing. A second sled test was conducted to confirm the performance matched the new virtual design and this time, no kinematic issues were found and critical injury response accuracy improved further to 85%-95%.

The project demonstrated the feasibility of developing a protection system that can effectively protect cab engineers by applying modern occupant protection technologies, through the use of state-of-the-art analytical techniques and test methodologies.

"The combination of Altair ProductDesign's expertise and the HyperWorks software suite were essential to our success in meeting 100% of our performance criteria in just two tests."

Anand Prabhakaran, Vice President, Sharma & Associates