

Virtual Evaluation of Seat Performance using ESI's Virtual Seat Solution



Fig. 1: Whiplash real and virtual tests with ESI's Virtual Seat Solution

Challenge

Before the use of Computer Aided Engineering (CAE) in crash and occupant safety analysis, seat makers, like the global seat system creator, TACHI-S, performed several analytical calculations and experimental tests to check how a seat fulfilled standard requirements, such as whiplash criteria of the JNCAP protocol. These iterations consumed a lot of time and money during the seat development process.

Benefits

With virtual seat prototyping, iterations are made to the design early in the development process, as designers tackle new challenges such as evolving standards for managing whiplash. Using Virtual Prototypes shortens total development time and reduces testing expenses.

"At TACHI-S, we have successfully reached greater design targets, fulfilled safety requirements, and improved overall quality in trial phases by adding Virtual Seat Solution into our seat development process. Because there are more than 300 mechanical elements in one seat, designing the seat using virtual seat prototyping at the early stage has greatly shortened the development time."

Mr. Inoue,

Manager of CAE Evaluation Section,
Test Engineering Department, TACHI-S

Story

A car seat is a key component of the car's interior which connects humans with vehicles and there are high levels of expectation related to its appearance and performance. The seat must be designed and produced to satisfy a wide range of requirements such as comfort, feel of touch, maneuverability, ergonomics through seat adjustments and armrest, safety requirements, product durability, and reduction of vibration to mitigate driver fatigue in long haul driving.

Why TACHI-S decided to adopt ESI's Virtual Seat Solution

Automotive seat manufacturers face continuous challenges. The number of seat models and variants multiply with local market specifications, while shorter development cycles are required. At the same time, the requirements and level of expectations regarding vehicle safety grow every year. TACHI-S is an independent car seat maker working for major Japanese and foreign automotive OEMs. To respond to the increasing sophistication of seat safety, TACHI-S, who implemented ESI's multi-domain simulation software Virtual Performance Solution since 2010 for crash simulation and more, decided to start using ESI's Virtual Seat Solution.

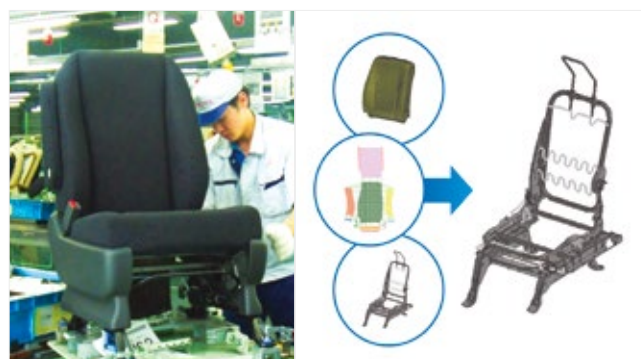


Fig. 2: Real and virtual seat assembly

The challenge of NCAP whiplash seat certification

When a car manufacturer develops a new model, it performs crash safety performance tests on cars occupied by crash test dummies. The dummy's injuries are assessed after each collision. This New Car Assessment Program (NCAP), originated in the United States in 1979, and corresponding tests have since been defined locally in Japan (JNCAP) and Europe (Euro NCAP).

These NCAP tests are published as a yardstick for car safety and test results can even impact insurance rates in some countries. Requirements evolve continuously. In recent years, a new set of tests has been introduced in NCAP to assess the performance of seats in relation to whiplash and the risk of associated neck injuries in low severity rear impacts.



Virtual whiplash performance test

The JNCAP protocol includes both a static and a dynamic evaluation. The starting point consists in seating an H-Point dummy equipped with a Head Restraint Measuring Device (HRMD). This device is used to locate the H-Point, and adjust the backrest to match the design position of the head restraint with respect to the head. These preliminary static measurements, performed with the HRMD, ensure the correct initial position for the BioRID II crash dummy, as it has a significant influence on the dynamic sled test result and the overall score.

TACHI-S decided to review its process and perform virtual whiplash performance tests, according to the JNCAP protocol, to evaluate neck injury value before completing the actual JNCAP assessment.

Step 1: Seat Trim Assembly

To predict whiplash accurately, it is necessary to have an accurate virtual seat model. So, as a first step, the seat assembly process is performed with a detailed model of the trim cover and polyurethane pad. This step enables the prediction of the internal stresses in the trim cover and polyurethane pad that appear during the seat assembly process. Once completed, the dummy's sitting posture and the H-Point can be accurately predicted.

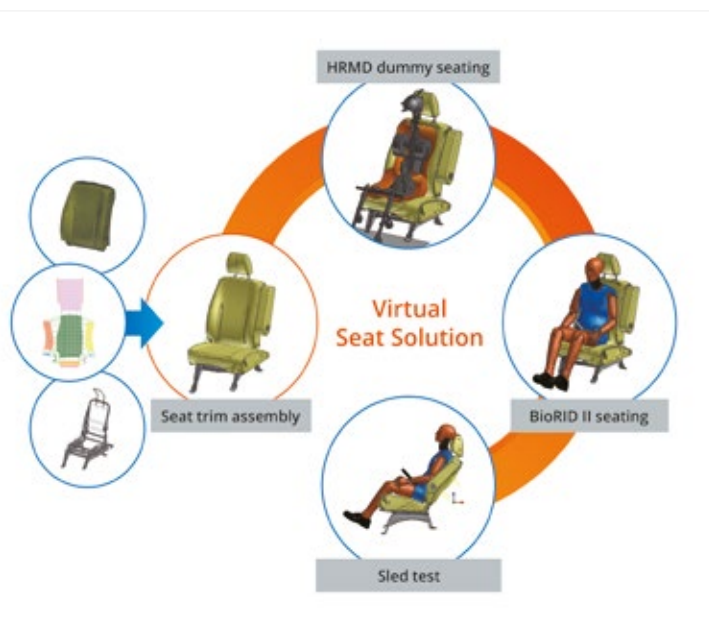


Fig. 3: Whiplash process followed by TACHI-S

Steps 2 and 3: HRMD and BioRID II seating

In the second step, the HRMD dummy is seated to measure the H-Point, the torso angle, the backrest distance and the relative positions between head and headrest. This step is followed by the BioRID II crash dummy seating. The initial posture of the BioRID II dummy is a direct consequence of the measurements with the HRMD dummy. These two steps are carried out in static seating simulation with Virtual Seat Solution.

Step 4: Sled test

A sled test is performed at a low speed velocity of 20 km/h. Injury value is determined by measuring the acceleration and the load on the head and neck of the BioRID II dummy. A score is then calculated.



"Seat crash performance must be evaluated with the occupant seated in a realistic position. Being able to predict the exact sitting posture of the dummy with ESI's Virtual Seat Solution, has improved the accuracy of crash and safety prediction. It is a big step towards decreasing the number of real prototypes we have to build and test."

Mr. Okano,
Manager of CAE Evaluation Section,
Test Engineering Department, TACHI-S

Next step with a new and improved TACHI-S car seat

TACHI-S announced in 2012 a new standard frame, the "TTK frame", which is safe, lightweight, and compact and offers exceptional versatility for various types of car seats. It is available to car makers around the world.

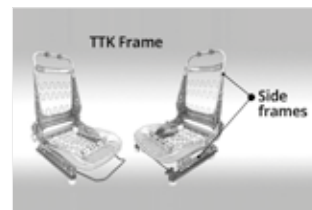


Fig. 4: TTK Frame: specifications for manual and power seats

To find out more about ESI's Virtual Seat Solution, please visit: www.esi-group.com/virtualeat



virtual seat | ground transportation



About TACHI-S

TACHI-S, an independent car seat maker, does everything from developing to producing automotive seats. They offer car seats, as well as seat components, to domestic and foreign car makers alike. Some of these car makers include: NISSAN MOTOR CO. LTD., HONDA MOTOR CO., LTD., TOYOTA MOTOR CORPORATION, HINO Motors, LTD, UD Trucks Corporation, ISUZU MOTORS LIMITED, Mitsubishi Motors Corporation, GEELY AUTOMOBILE. More than half a century since its establishment in 1954, TACHI-S has been making car seats, which provide reliability and inspiration. In recent years, to deal with diverse demands from users all over the world, globalization is in progress by establishing new production bases around the world, such as Asia, North, Central and South America and Europe.

About ESI GROUP

ESI is a pioneer and world-leading provider in Virtual Prototyping that takes into account the physics of materials.

ESI boasts a unique know-how in Virtual Product Engineering, based on an integrated suite of coherent, industry-oriented applications. Addressing manufacturing industries, Virtual Product Engineering aims to replace physical prototypes by realistically simulating a product's behavior during testing, to fine-tune fabrication and assembly processes in accordance with desired product performance, and to evaluate the impact of product use under normal or accidental conditions.

ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping. These solutions are delivered using the latest technologies, including immersive Virtual Reality, to bring products to life in 3D; helping customers make the right decisions throughout product development. The company employs about 1000 high-level specialists worldwide covering more than 40 countries. ESI Group is listed in compartment C of NYSE Euronext Paris.

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