CSRC Leads the Way for Seat Belt Research on Pregnancies

December 19, 2023

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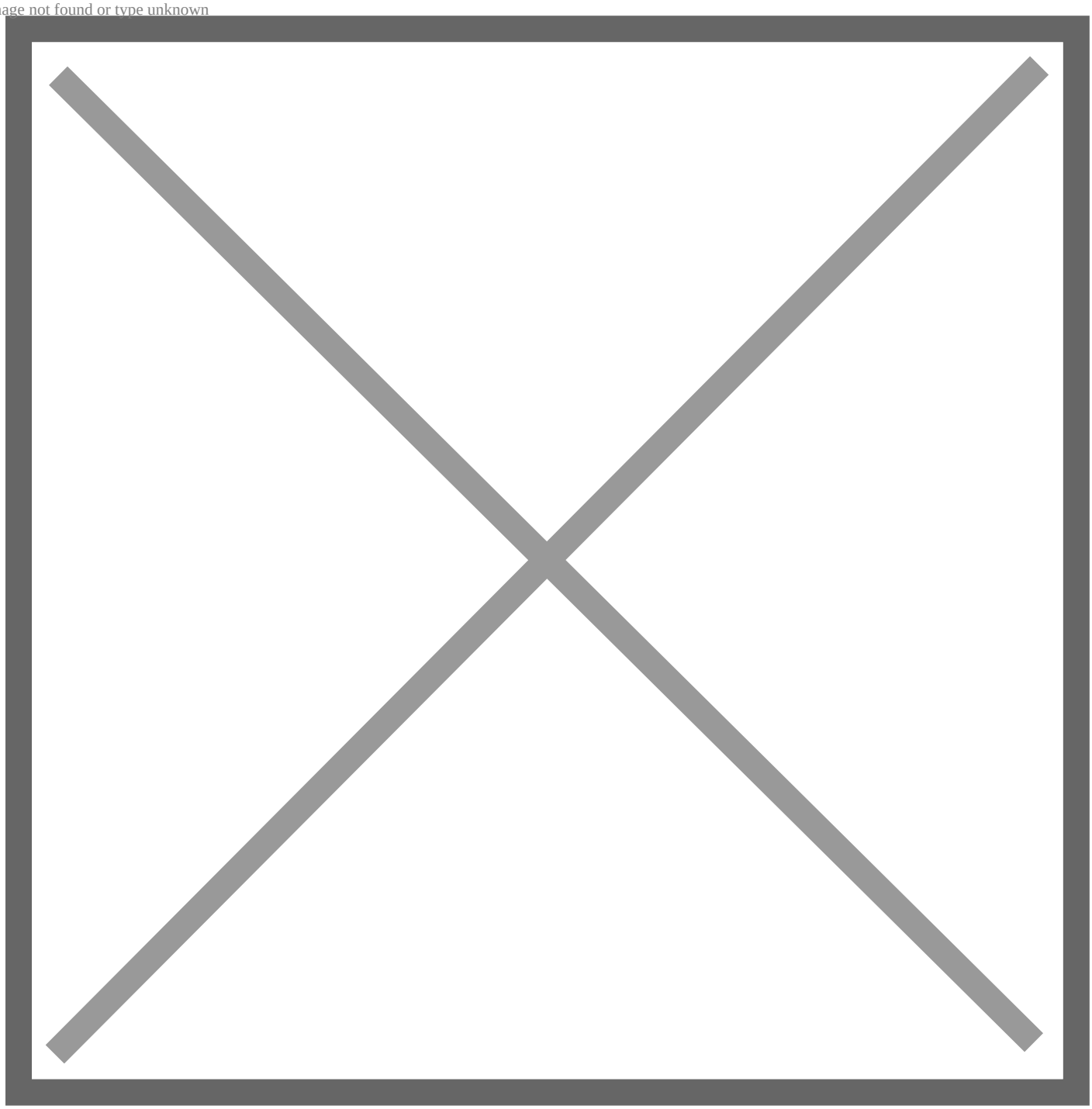


It began with a simple question: is there a way to confirm seat belt safety for pregnant bellies?

A Toyota team of four women and one man presented an idea in late 2022 that was simple but powerful: pregnant customers do not always feel they are safe and secure when using seat belts found in cars today due to seat belts fitting differently on pregnant bodies. Could Toyota help change that?

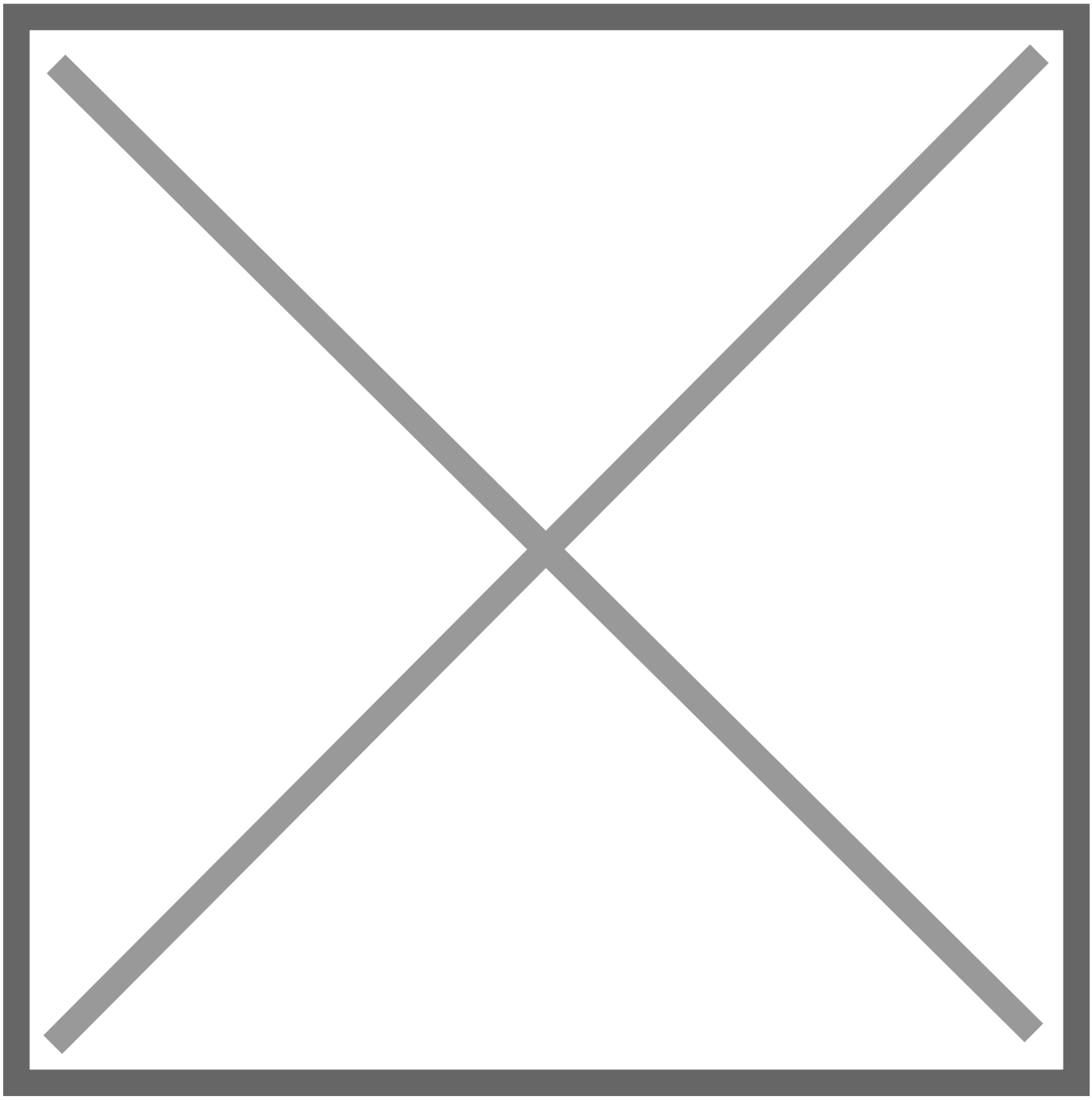
“The common misperception that seat belts aren’t safe for pregnant women surprised me,” said Juliana Said, a body design engineer at Toyota Motor North America (TMNA) R&D. “Some people were even avoiding using them. The idea was: can we help show that the designs are safe, while investigating areas for further enhancement?”

When Said and her colleagues started to look at the issue, they encountered unexpected challenges. There was limited research about the effectiveness of seat belts with expectant mothers or their babies. Additionally, the aftermarket was filled with untested, unverified safety devices.

But the biggest challenge to overcome is a widespread (and erroneous) belief among pregnant women and their families that seat belts are unsafe for a fetus during a crash – and that belief is so entrenched that some expectant mothers drive unbelted.

In fact, today’s seat belts are safe for pregnant women. When properly worn, statistics show that belted pregnant women are much safer in crashes than those that don’t wear them. But a false narrative has developed that they can harm unborn babies in crashes.

Said and her team started to work with the company’s Collaborative Safety Research Center (CSRC) in Ann Arbor, Michigan. CSRC contracted with the University of British Columbia, which has access to a specialized magnetic resonance imaging machine designed to map anatomies of all sorts of body shapes in a seating position.



While pregnant women properly wearing seat belts have better outcomes than no seat belts, there are opportunities through new research to further explore seat belt fit for pregnant women, according to Jason Hallman, senior research manager for CSRC. The center and its research collaborators set about the task of creating the data that engineers can use to potentially come up with future designs.

“We design seat belts using standardized dummies and processes,” Hallman said. “There’s no standardized dummy, no standardized tools available specifically for assessing pregnant occupant safety. Therefore, the industry doesn’t have a clear understanding of how future seat belts could better protect pregnant women or fetuses during a crash.”

Working with the data generated at UBC, CSRC will create a computerized, three-dimensional model of pregnant bodies. And not just one body, but how different shapes and sizes look, with detailed representation of bones, the spine, internal organs, and various body tissues in different phases of pregnancy.

In the future, the research project could help enhance one of Toyota's research achievements, the THUMS digital crash injury model. THUMS is like a virtual crash-test dummy, constructed from painstaking research on different kinds of human tissue and how they react to crash forces.

The University of British Columbia research team is using a unique kind of MRI machine to create the digital, three-dimensional representations of pregnant drivers, said Peter Cripton, director of the Orthopedic and Injury Biomechanics Group at UBC.

The research team devised a method to scan people seated in a car position. There are two big plates three to four feet apart. The test subject sits in an automotive seat. A smaller MRI device is moved several times to stitch together different views until there's an entire body image. Researchers are looking at how seat belts interact with bones and internal organs.

Cripton said that one of the great strengths of working with Toyota is that it's a safety-minded manufacturer with substantial knowledge about building safe products for customers.

"It's really exciting to me about working directly with an automotive manufacturer," Cripton said. "We will publish this data together, and make it available to other injury biomechanics researchers, too. Toyota will do the work, but it won't just be Toyota that gets the benefit."

The pregnant-body research and models may shed light on another top topic among parents: whether third-party devices designed for pregnant women add a safety benefit. There are huge pads to put on top of the seat cushion, a specialized lap belt, and a kind of metal shield, for example. These types of devices may seem logical, but they're not subject to the kind of rigorous testing used for seats, belts, airbags, and other parts of the car's interior. With better information in the future, such as virtual pregnant crash-test dummies, researchers will be able to draw better conclusions.

"That product may seem obvious to you, but it may not be compatible with the way your car works," according to Said.

**image credit: UBC Upright Open MRI Research*