Name: _____ Date: _____

Crash Test Measures

There is a very diverse fleet of vehicles on our roads. The majority of these vehicle makes and models underwent crash testing to ensure that they were reasonably safe before they were sold to consumers.

A crash test dummy is a tool engineers developed to help them collect data from such testing. Different designs of crash test dummies are equipped with different arrays of sensors. Accelerometers are sensors used to collect data on acceleration during a collision. If a high acceleration is detected in a particular direction, the chances of injury are higher. Load sensors are a different type of sensor that measures the amount of force on a particular part of the body during a collision.

Engineers strategically place sensors on the crash test dummy in locations where people can be most impacted by a car crash. These include the head, neck, and chest. Data from these sensors help engineers identify and quantify how a person is impacted in these most likely injury locations or injury indicators of potential occupants.

One example of this is blunt impact injury. The mechanism for this is related to the degree of deformation of the tissue exceeding its recoverable (elastic) limit. So, a measure of chest deformation in a test dummy can provide a measurement to help quantify the risk of injury to that part of a person's body and can help improve the vehicle design. The table below summarizes some of the measures that engineers use to quantify safety.

Injury Parameter Cutoff Values Associated with Possible Injury Protection Ratings

Body region	Parameter	Good to acceptable	Acceptable to marginal	Marginal to poor
Head	Acceleration (m/s^2)	7.8	9.8	11.8
Neck	Force (N and kN)	2,600 N (2.6 kN)	3,200 (3.2 kN)	4,000 (4.0 kN)
Chest	Deformation (mm)	50	60	75

While sensors on crash test dummies can sample hundreds to thousands of readings per second, they cannot capture all interactions happening in the system. Slow-motion cameras are also used to record how the body

moves as it interacts with different parts of the vehicle and its safety features. Paint is also placed on the crash test dummy so engineers can tell where different parts of the crash test dummy made contact with the vehicle.

- How is measuring acceleration related to the net force acting on the head of the crash dummy?
- How is deformation related to the net force acting on the chest of the crash dummy?
- What do the patterns in the data tell you about the relationship between injury and the magnitude of the net force applied to that part of the body?

Reference

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