Making Safe Vehicles

Basic Policy

Toyota believes that safety is fundamental for making vehicles. In order to provide vehicles that attain high levels of safety under various conditions and offer an optimal driving experience, Toyota is engaged in developing safety technology using standards established at levels above those legally required, on the basis of the following four points: (1) Comprehensive measures taken from a broad perspective embracing vehicles, people, and the traffic environment; (2) Development of safety equipment and vehicle structures based on advanced technology; (3) Vehicle manufacturing based on results of accident survey and analysis; (4) Overall balance of customer requirements and social needs.

Starting from this approach, Toyota promotes concrete measures to make safe vehicles, based on active safety to make the vehicle less susceptible to accidents and passive safety to minimize the damage or injury caused if an accident does occur.

Comprehensive Measures Taken by Toyota To Make Safe Vehicles

![Diagram]

People

Vehicles

Traffic environment

Awareness-enhancing activities

Development of safety technologies and practical application

Maintenance of traffic environment

Collision Tests and Simulations

To analyze the rate of acceleration of the vehicle and the motion of the occupants when a vehicle is involved in a collision, as well as the effect of load and other factors on occupants and pedestrians, Toyota stages experimental accidents with real vehicles and utilizes the findings for vehicle manufacturing. Every year over 1,000 such experiments are staged using more than 100 dummies of ten types differentiated according to age, sex, physical build and other factors.

In order to complement this experimental data, Toyota also makes active use of CAE,* and has reached a level where detailed predictions can be made on deformation and load.

* CAE (Computer Aided Engineering): A technology that uses computers to simulate physical phenomena (deformation, stress, heat, vibration, etc.) and utilize the results in designing products and resolving issues.

Virtual Human Body Model THUMS

The virtual model of the human body used to simulate effects on the body, which cannot be measured in collision experiment dummies, is called THUMS (Total Human Model for Safety). From human body shape to bone strength and skin flexibility, right down to ligaments and tendons, the simulation reproduces conditions close to those of the human body and makes it possible to predict the injury to the various parts of the body in a way which was not fully possible with collision dummies. Using this model, Toyota is engaged in vehicle body development designed to further enhance passive safety through elucidation of the various mechanisms by which damage and injury occur in an accident.

Active Safety

In vehicle safety, what comes first is the active safety approach, which makes vehicles less susceptible to accidents. The basis of active safety technology is to allow the essential functions of the vehicle—running, turning, and stopping—to be executed in line with driver intentions, and Toyota therefore works to improve these three functions using the latest technology.

As well as integrating findings from ergonomics and traffic psychology in its development process, Toyota also considers the following points to be important: (1) Functions to assist the driver in performing driving operations; (2) Easy driver access to information on the vehicle and its surroundings during operation; (3) Transmission of data to other vehicles; (4) Improvement of the driving environment.

New Technology Developed in FY2002

Pre-Crash Safety

Around 70% of fatalities and serious injuries are caused by delayed reaction, for instance not watching the road ahead or failing to check for safety. Survey results show that in 40% of frontal collisions, measures to avoid accident occurrence were not implemented.* Responding to these facts, Toyota has developed the "Pre-crash Safety" system which combines active safety and passive safety. The system assesses in advance when a collision is unavoidable and preemptively activates safety devices to help minimize damage. It is provided as an optional feature on the Harrier launched in February 2003.

The system consists of a newly developed Pre-crash sensor that determines in advance whether or not a collision is imminent, the Pre-crash Seatbelt that increases passenger-restraint performance by retracting the seat belt in advance, immediately after an unavoidable collision is identified, and the Pre-crash Brake Assist that provides increased braking force early on to help reduce collision speed.

The Pre-crash Sensor, which is the pivotal element of the system, is a key technology developed through advances in ambient observation technology based on millimeter-wave radar and other systems.
Improvement of Collision Avoidance Assistance System

It is said that approximately 20% of serious accidents are caused by a loss of control, such as lateral skid. In accidents resulting from lateral skid, the following systems are seen as beneficial: ABS (Anti-lock Brake System), TRC (Traction Control), and VSC (Vehicle Stability Control).

VSC is a device designed to help prevent the occurrence of lateral skid due to sudden steering operations or slippery road surfaces. ABS and TRC by contrast, help prevent skidding during deceleration and acceleration respectively.

A Brake Assist system that augments braking force is also thought to be useful in preventing accidents during sudden stops.

Toyota plans to expand the use of preventive safety devices, such as VSC and the Brake Assist system in nearly all passenger vehicle series sold nationwide by 2005.

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Passive Safety

Consideration also needs to be given in accidents to protection of the vehicle occupants and of the pedestrians and cyclists/motorcyclists who may be in a collision with the vehicle.

Passive safety, as Toyota sees it, embraces a wide range of aspects including vehicle bodies that absorb impact effectively, strong cabins that ensure survival space, restraining devices and interior materials that protect occupants, door structure that facilitates escape and rescue, and prevention of the start and spread of fire.

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Introducing Japan’s First ISO-FIX Child Safety Seat

In 1999, Toyota introduced Japan’s first child safety seat conforming to ISO-FIX* standards which allows for easy and reliable installation. It is mounted on the seat using dedicated ISO-FIX compliant anchors, so if the vehicle is built to conform to it, it can be easily and reliably used.

Most of Toyota’s vehicles conform to ISO-FIX standards, and Toyota is striving to popularize the use of CRS (Child Restraint System) by also providing child safety seats that conform to ISO-FIX standards for both infants and young children.

Toyota’s ISO-FIX child safety seats have been evaluated highly in passive safety comparison tests conducted by the National Consumer Affairs Center of Japan (NCAC).

*ISO-FIX: An ISO(International Organization for Standardization) standard for child safety seat attachments created to prevent improper installation of child safety seats, improve vehicle conformity and set an internationally uniform attachment method.

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Omni-Direction Compatibility

Compatibility is an approach to ensuring safety on both sides in collisions between large vehicles, small vehicles, trucks and many other kinds of vehicles. Differences in vehicle weight, height and other factors make a great difference in the extent of damage in the event of a collision, and it is important that vehicle designs take these differences into account. Toyota applies this approach not only to frontal collisions, but also to side-on and rear collisions, aiming for improvement of omni-direction compatibility in pursuit of passive safety.