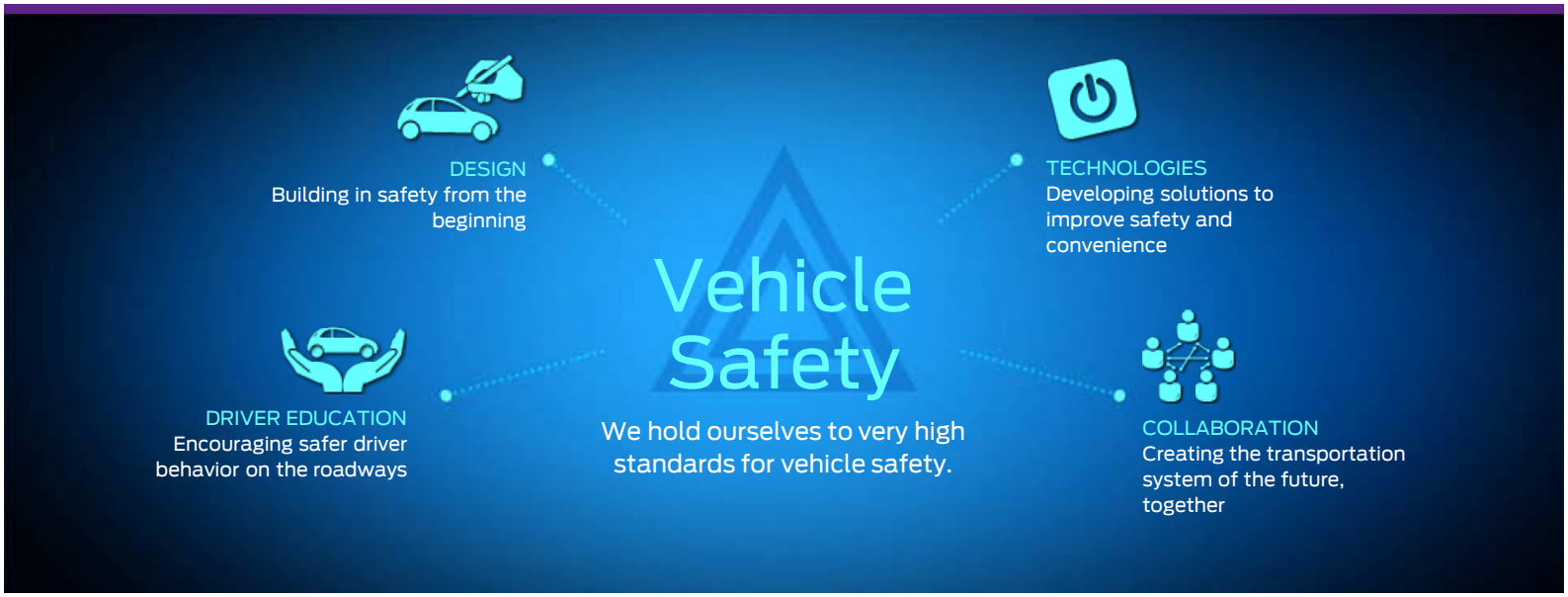


At Ford, we hold ourselves to very high standards for vehicle safety. The fact is, vehicle safety is a critical part of our brand promise to Go Further. We aim to give customers peace of mind and make the world safer by developing advanced safety technologies and making them available across a wide range of vehicles.

We are specifically committed to:

- designing and manufacturing vehicles that achieve high levels of performance in real-world safety and in government- or nonprofit-sponsored crash tests and offer innovative safety and driver assist technologies;
- meeting or exceeding all regulatory requirements for safety;
- providing information, educational programs and advanced technologies to assist in promoting safe driving practices;
- playing a leadership role in vehicle safety research and innovation; and
- playing a leadership role in research and development relating to “connected vehicles.”

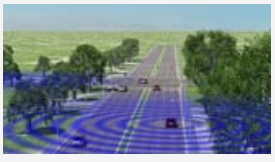
Ford has delivered on these commitments and remains among the global leaders in vehicle safety. To date, for example, Ford Motor Company has earned a total of 91 “Top Safety Picks” from the Insurance Institute for Highway Safety (IIHS) – more than any other manufacturer in the eight-year history of that crash testing program.[1] To earn a Top Safety Pick, a vehicle must receive a rating of “good” in offset frontal impact, side impact, rear impact and roof strength evaluations, and offer electronic stability control. Starting in 2013, the IIHS added a new rating of “Top Safety Pick+”. To achieve this rating, a vehicle must receive a “good” in the above tests and a “good” or “acceptable” in a new small overlap rigid barrier test.

See the next page for notable safety-related highlights from 2012 and early 2013.

93 percent
of 2013 model year Ford Motor Company vehicle nameplates tested were named IIHS Top Safety Picks

Driver Education

In 2012, Ford’s flagship driver education program – Ford Driving Skills for Life – visited more than 175 high schools in 10 U.S. states and Puerto Rico.



Connected Vehicles

We are taking part in numerous research projects – on our own

and in cooperation with others – to develop and demonstrate “connected vehicle” technologies.

1. Historic totals include all brands and entities owned and controlled by the manufacturer during the 2006–2013 calendar years. For Ford Motor Company, this includes Ford and Lincoln, as well as Mercury (through the 2011 model year) and Volvo (through the 2010 model year). Totals do not include Mazda.

Highlights

Ford's recent safety highlights include the following:

- For the 2013 model year, 13 Ford Motor Company vehicles earned Top Safety Picks from the Insurance Institute for Highway Safety (IIHS): the Ford Fiesta (sedan and hatchback), Focus, Fusion, Taurus, Edge, Explorer, Escape, Flex and F-150 (crew cab) and the Lincoln MKZ, MKS, MKT and MKX.
- Two Ford Motor Company vehicles earned a Top Safety Pick+ for the 2013 model year: the Ford Fusion and Lincoln MKZ.
- The Ford Fusion has now been an IIHS Top Safety Pick for five years in a row (2009–2013).
- Also for the 2013 model year, seven Ford Motor Company vehicles earned the highest possible Overall Vehicle Score of five stars in the New Car Assessment Program (NCAP) of the U.S. National Highway Traffic Safety Administration (NHSTA). These five-star vehicles include the Ford Focus, Focus BEV, Explorer, Taurus and Fusion and the Lincoln MKS and MKZ.
- In the 2012 European NCAP assessments, the Ford B-MAX, Fiesta and Kuga earned five-star safety ratings. In addition, the B-MAX and Kuga received Euro NCAP's Best in Class recognition for the highest safety performance scores in their vehicle segments.
- The new Ford Transit Custom and Tourneo Custom are the first van and "kombi" (i.e., multi-purpose vehicle), respectively, to achieve five-star ratings in the new Euro NCAP heavy vehicle assessment. The Transit also received Euro NCAP's Best in Class recognition for the highest safety performance score in its segment.
- Ford has an industry-leading total of seven Euro NCAP Advanced rewards for our Lane Keeping Aid, Active City Stop, Forward Alert, Lane Keeping Alert, MyKey®, Emergency Assistance and Driver Alert technologies.
- In the Latin NCAP, the new Ford Fiesta achieved a four-star rating for adult protection and a four-star rating for child protection.
- The 2013 Ford Taurus Police Interceptor is the only police pursuit sedan on the market that has been tested in 75-mph rear-end crash tests.
- Our available rear-seat inflatable safety belts, launched on the 2011 Ford Explorer, are an automotive industry exclusive and have won numerous awards. In the 2013 model year, we expanded the availability of these safety belts in North America to the Ford Flex and the Lincoln MKT and MKZ.
- Lane Keeping System, a driver assist feature, was launched in 2011 in Europe on the Ford Focus. Its availability has been expanded to North America on the 2013 Lincoln MKS, MKT and MKZ and the Ford Explorer and Fusion.
- For the 2013 model year, we expanded the availability of Curve Control, a driver assist technology that helps slow the vehicle when it senses the driver is taking a curve too quickly. In North America, Curve Control is now offered on the Ford Explorer, Taurus, Flex and Escape, as well as the Lincoln MKS and MKT. In Europe, it is available on the Ford Kuga.

Related links

This Report

- Accident Avoidance and Driver Assist Technologies

Vehicle Websites

- Ford Fiesta
- Ford Focus
- Ford Focus Electric
- Ford Fusion
- Ford Taurus
- Ford Escape
- Ford Edge
- Ford Explorer
- Ford Flex
- Ford F-150
- Ford B-MAX
- Ford Kuga
- Ford Transit Custom
- Ford Tourneo Custom
- Lincoln MKZ
- Lincoln MKX
- Lincoln MKS
- Lincoln MKT

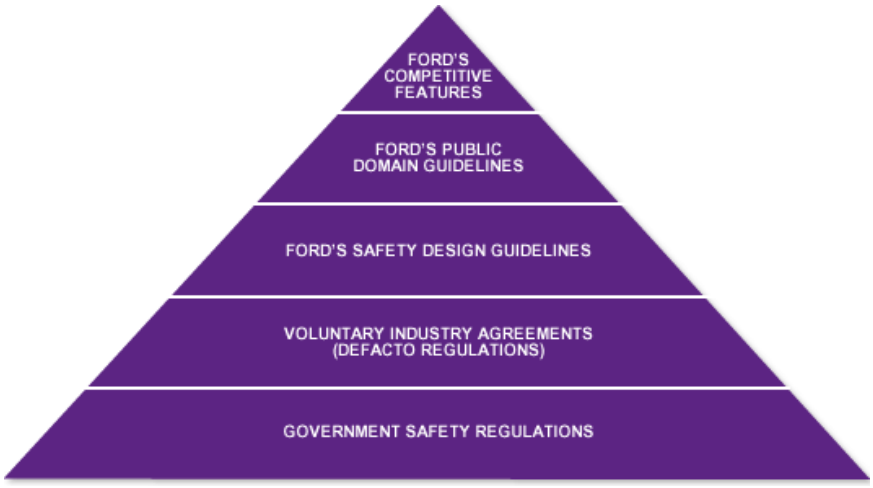
External Websites

- European New Car Assessment Program
- Insurance Institute for Highway Safety
- Latin New Car Assessment Program
- U.S. National Highway Traffic Safety Administration's New Car Assessment Program

How We Manage Vehicle Safety

At Ford, we design and manufacture vehicles that achieve high levels of vehicle safety for a wide range of people over a broad spectrum of real-world conditions. Real-world safety data, driver behavior, research, regulatory requirements and voluntary agreements provide much of the input into our safety processes, including our Safety Design Guidelines (SDGs) and Public Domain Guidelines (PDGs). (See graphic below.) The SDGs are Ford's stringent internal engineering design targets that exceed regulatory requirements and define additional requirements that are not regulated. The PDGs are Ford guidelines that focus specifically on helping to ensure that our vehicles earn high ratings in relevant public domain assessments (i.e., vehicle safety assessments performed by government or nonprofit entities).

Our PDGs are continually reviewed for possible revisions to address ongoing changes in major public domain vehicle testing programs around the world. Please see the Public Domain Ratings case study for information on these programs.



Internally, Ford utilizes engineering analyses, extensive computer modeling, and crash and sled testing to evaluate the performance of vehicles and individual components. These rigorous evaluations help to confirm that our vehicles meet or exceed regulatory requirements and our own even-more-stringent internal guidelines. Our state-of-the-art crash-test facilities include the Safety Innovation Laboratory in Dearborn, Michigan, and the extensive crash-test facilities in Merkenich, Germany, and Dunton, England. We also operate a high-tech, full-motion driving simulator in Dearborn called VIRTTEX, for VIRtual Test Track EXperiment.

Haddon Safety Matrix

We use the Haddon Safety Matrix to take a holistic view of the factors that may affect vehicle safety. (The matrix was developed by William Haddon, a former administrator of the U.S. National Highway Traffic Safety Administration and also former president of the Insurance Institute for Highway Safety.) The Haddon Matrix illustrates how traffic safety can be the product of complex interactions among the driver, the vehicle and the driving environment.

The Haddon Matrix is used to look at crashes in terms of causal and contributing factors, including human behavior, vehicle safety and the driving environment. Each factor is then considered in the pre-crash, crash and post-crash phases. In the pre-crash phase, the focus is to help avoid the crash. In the crash and post-crash phases, the primary objective is to help reduce the risk of injury to occupants during and after a collision. Another goal is to minimize the amount of time that

Related links

This Report

- Case Study: Public Domain Ratings

elapses between the crash and when help arrives.

	Human Behavior	Vehicle Safety	Environment
			
Pre-Crash Accident avoidance	• Research • Education • Advocacy	• Crash avoidance technologies • Security	• Road design for accident avoidance • Traffic control
Crash Occupant protection	• Technology and proper use	• Restraints • Structures that absorb and reduce crash energy and intrusion	• Road design for injury mitigation • Research
Post-Crash Injury mitigation	• Telematics	• Post-crash notification	• Emergency medical services
Examples of Ford Actions	• SYNC® technology • MyFord Touch® driver connect technology • MyKey® • Ford Driving Skills for Life	• Accident avoidance features • Inflatable safety belts • Roll Stability Control®	• Accident research • Development of “vehicle-to-infrastructure” communication systems

Encouraging Safer Driving

Driver behavior is a key contributing factor in many vehicle crashes.[1] We at Ford have developed an array of programs and technologies that help to encourage safer behavior on the roadways, for both experienced and novice drivers.

Ford Driving Skills for Life (Ford DSFL), our flagship driver-education program, demonstrates our commitment to help new drivers to improve their motoring skills. In the U.S., Ford DSFL focuses on teen drivers; in our Asia Pacific and Africa markets, the program is aimed at novice drivers of all ages.

In 2012 in the U.S., Ford DSFL visited more than 175 high schools in ten states and Puerto Rico, where we held assemblies, safe driving activities and hands-on training. We trained more than 9,000 students and parents with hands-on instruction and reached nearly 20,000 students with safe driving messaging through school assemblies. The Ford DSFL program delivers a full day of multifaceted activities that build young drivers' skills in four key areas: driver distraction, speed/space management, vehicle handling and hazard recognition. Ford DSFL continues to provide interactive web-based training called "The Academy" at www.drivingskillsforlife.com, and offers free materials upon request for students, educators, parents and community organizations.

In September 2012, Ford DSFL collaborated with *Variety* to encourage safe driving at the annual Power of Youth event, which honors the charitable efforts of Hollywood's young entertainers. Ford DSFL was onsite at Paramount Pictures Studios for the event, taking hundreds of teens through a driver distraction course, providing safe driving tips and demonstrating new technologies designed to help make driving more comfortable, convenient and safe for young drivers.

Ford Driving Skills for Life, our driver education program, collaborated with Variety to encourage safe driving at an event honoring the charitable efforts of Hollywood's young entertainers.

In Ford's global markets, Ford DSFL celebrated its fifth year training newly licensed drivers in Asia and Africa, with programs in China, India, Taiwan, South Africa, Thailand, Vietnam, the Philippines, Indonesia and Malaysia. Also in 2012, a pilot Ford DSFL program took place in Vancouver, British Columbia, and we also launched the program for the first time in the Middle East – in the United Arab Emirates. In all of the global markets in which Ford DSFL operates, the program is tailored to reflect the local driving environment and road conditions. So far, more than 63,000 people have participated in the program across the global regions.

2012 marked the fifth year that Ford DSFL participated in the Operation Teen Safe Driver program in partnership with the Illinois Department of Transportation, Secretary of State and state police. The program gets high school students directly involved in safe driving behaviors by challenging them to develop and implement teen safe driving community-awareness campaigns using Ford

Related links

Ford Websites

» Ford Driving Skills for Life

External Websites

» Operation Teen Safe Driving

DSFL resources. Since the program's launch in 2007, teen vehicle crash deaths in Illinois have decreased by 48 percent. In 2012 in Michigan, Ford DSFL launched "Strive 4 a Safer Drive," a pilot program modeled after the Illinois program.

In 2013, Ford DSFL will take its program to more than 200 high schools in eight U.S. states, reaching more than 40,000 students. Ford DSFL will also continue its global expansion, including developing programs in major European markets as well as Canada.

On the technology side, the Ford MyKey® system is an innovative technology designed to help parents encourage their teenagers to drive more safely. MyKey allows owners to program a key that can limit the vehicle's top speed to 65, 70, 75 or 80 mph and also can invoke SYNC's Do Not Disturb feature, which sends incoming phone calls and text messages to the paired phone's mailbox. MyKey encourages safety-belt usage by enabling Ford's Belt-Minder® to chime every minute indefinitely until both of the front passengers are buckled in, rather than ceasing after five minutes, and also through a "no belt/no tunes" feature that mutes the audio system until the belt is buckled. In addition, MyKey provides an earlier low-fuel warning (at 75 miles to empty rather than 50); sounds speed-alert chimes at 45, 55 or 65 mph; and will not allow manual override of other safety systems. MyKey is available on nearly all Ford Motor Company retail vehicles in North America, and its availability is expanding to other regions.

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1. U.S. Department of Transportation, National Highway Traffic Safety Administration, *National Motor Vehicle Crash Causation Survey: Report to Congress* (Washington, DC: U.S. DOT, July 2008).

Safety and Driver Assist Technologies

Because of our commitment to vehicle safety, Ford offers innovative features and technologies on our Ford and Lincoln vehicles. In this section we discuss three categories of technologies and provide a few examples of Ford's offerings in each. The categories are:

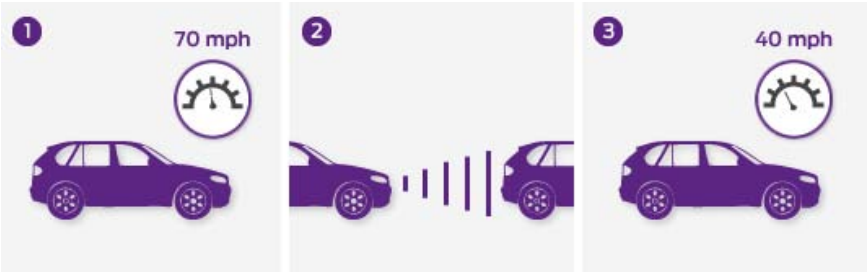
- Accident Avoidance and Driver Assist Technologies
- Occupant Protection Technologies
- Post-Crash Response Technologies

Accident Avoidance and Driver Assist Technologies

A variety of Ford technologies, in addition to each vehicle's handling and braking capabilities, can assist drivers by helping the driver control the vehicle or alerting the driver to potential risks. Also, these technologies can support everyday driving tasks by improving comfort and reducing demands on the driver. The all-new 2013 Ford Fusion is just one of the vehicles in the Ford lineup to offer a portfolio of these types of technologies.

The all-new 2013 Ford Fusion.

Adaptive Cruise Control



The Fusion offers Adaptive Cruise Control (ACC), for example. ACC helps drivers maintain a pre-set distance from the vehicle in front of them, using a radar module mounted at the front of the vehicle that measures the gap and closing speed to the vehicle ahead. The system automatically adjusts the speed of the car to help maintain a pre-set distance from the vehicle in front. Radar-based ACC is also available on the Ford Taurus, Edge, Flex and Explorer and the Lincoln MKZ, MKS, MKX and MKT.

Related links

Vehicle Websites

- Ford Focus
- Ford Fusion
- Ford Taurus
- Ford Escape
- Ford Edge
- Ford Explorer
- Lincoln MKZ
- Lincoln MKX
- Lincoln MKS
- Lincoln MKT

Ford.co.uk

- Ford Fiesta
- Ford B-MAX
- Ford Focus
- Ford C-MAX
- Ford Mondeo
- Ford Kuga
- Ford S-MAX
- Ford Galaxy
- Ford Transit
- Ford Tourneo Custom

Collision Warning with Brake Support

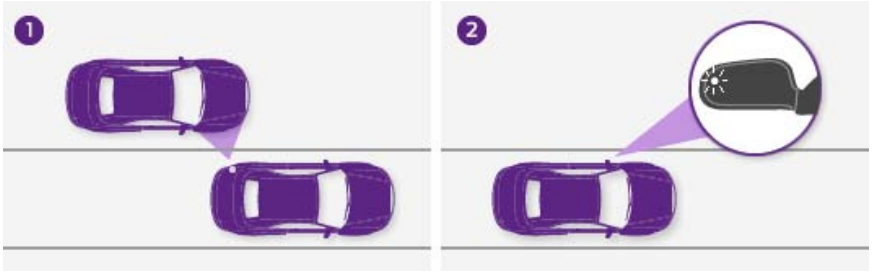
The all-new Fusion also offers Ford's Collision Warning with Brake Support technology, which uses the same radar module as the ACC to detect range and speed. Collision Warning with Brake Support activates a visual and audible warning when the system detects a high risk of collision with the vehicle in front. In addition, the brake system is pre-tensioned and the "servo boost" assistance system is modulated to provide faster brake performance (e.g., as soon as the driver lifts the gas pedal), if required by the driver. If the sensor becomes blocked by snow, ice or mud, the driver will receive a notice of reduced or suspended functionality. In addition to being available on the Fusion, this technology is available in North America on the Ford Taurus, Edge, Flex and Explorer and the Lincoln MKS, MKX, MKZ and MKT, and in Europe on the Ford Mondeo, S-MAX, Galaxy and Focus.

Lane Keeping System

The Fusion also offers Ford's Lane Keeping System, which consists of three elements to help a driver maintain proper lane position: Driver Alert, Lane Keeping Alert and Lane Keeping Aid. Using a small, forward-facing camera behind the inside rearview mirror, the system "looks" down the road, monitoring lane lines to determine that the vehicle remains in its lane. Driver Alert computes a "vigilance level" for the driver and displays it in the instrument cluster upon request. The vigilance judgment is based on statistical analysis of lane information collected by the forward-looking camera and the vehicle's yaw behavior. If the system-calculated vigilance level falls below a certain level (e.g., if the driver gets tired), visual and audible warnings are given. Lane Keeping Alert is designed to warn the driver, via a three-pulse vibration in the steering wheel, when the front-view camera detects that an unintentional lane departure is happening. Lane Keeping Aid goes a step further, applying a steering torque in the direction the driver needs to steer to keep the vehicle in the current lane.

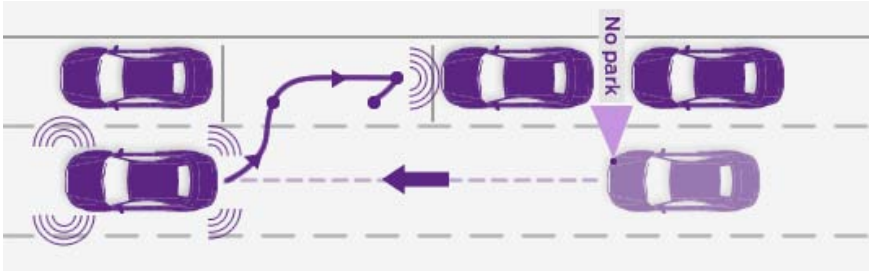
Lane Keeping System can be activated and deactivated manually via a switch on the turn indicator stalk. When the system is activated, drivers have the option of choosing Alert mode, Aid mode or a combination of both. The system is automatically deactivated at speeds below 38 mph, so as not to interfere in urban conditions when intentional lane crossing is relatively frequent. In North America, Lane Keeping System is available on the 2013 Lincoln MKS, MKT and MKZ and the 2013 Ford Explorer, in addition to the Fusion. In Europe, it is available on the Ford Focus, Kuga and C-MAX. Also, Lane Keeping Alert and Driver Alert are available in Europe on the new Ford Transit, Turneo Custom, Mondeo, S-MAX and Galaxy.

Blind Spot Information System (BLIS) with Cross Traffic Alert



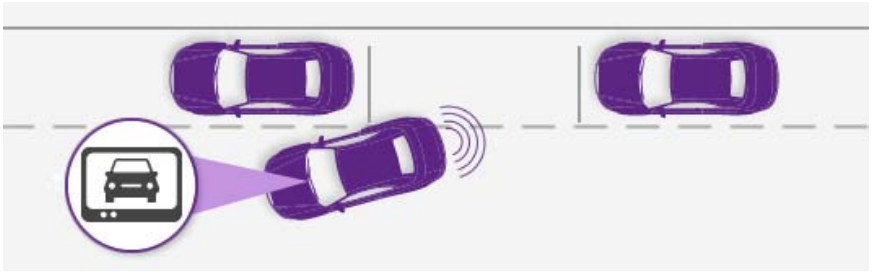
The Fusion's available Blind Spot Information System (BLIS) with Cross Traffic Alert uses rear corner-mounted, side-looking radar that detects other vehicles around the car and illuminates an indicator lamp in the rearview mirror. When backing out of a parking space, the same sensors can detect vehicles approaching from the sides that may not be visible to the driver. BLIS is also available on the Ford Taurus, Escape, Edge, Flex and Explorer and the Lincoln MKZ, MKS, MKX and MKT. BLIS (without the Cross Traffic Alert element) is available in Europe on the Ford Mondeo, S-MAX, Galaxy, C-MAX, Focus and Kuga.

Active Park Assist



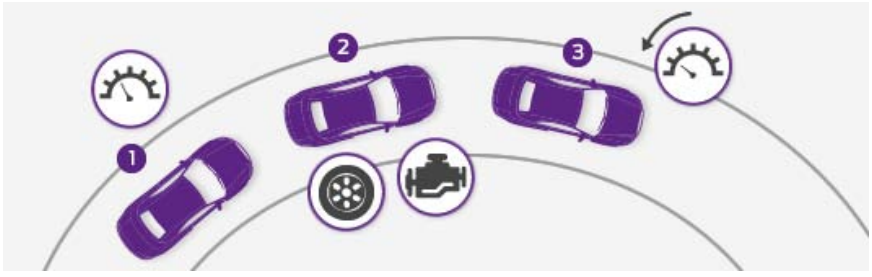
The new Fusion also offers Active Park Assist. Active Park Assist uses ultrasonic sensors, while the driver is slowly driving near parking spots, to measure the distance between cars. When a suitable parking space is found, Active Park Assist can steer the car into the parking space while the driver controls the shifting, accelerator and brake. Active Park Assist is also available on the Ford Focus, Fusion, Taurus, C-MAX, Escape, Flex and Explorer, as well as the Lincoln MKS, MKZ and MKT and in Europe on the Kuga, Focus and C-MAX.

Rear View Camera



Finally, the Fusion offers a Rear View Camera, which transmits an image of what is behind the vehicle when it is shifted in reverse. Rear View Camera is available on every Ford and Lincoln vehicle in North America. In Europe, Rear View Camera is offered on the Ford Focus, B-MAX, C-MAX, S-MAX and Kuga.

Curve Control



In addition to the technologies featured on the new Fusion, Ford offers several other accident avoidance and driver assist technologies on some of our other vehicles. Curve Control, for example, is designed to sense when a driver is taking a curve too quickly. In those situations, it rapidly reduces engine torque and can apply four-wheel braking, slowing the vehicle by up to 10 mph in about a second. The technology is designed to be effective on wet or dry pavement, and is expected to be helpful when drivers are entering or exiting freeway ramps with too much speed. In North America Curve Control is available on the Ford Explorer, Taurus, Flex and Escape, as well as the Lincoln MKS and MKT. In Europe, it is available on the Ford Kuga. A majority of Ford's North American products will offer Curve Control by 2015.

Active City Stop

Using a forward-looking radar sensor, Active City Stop is designed to detect objects in front of the car and constantly (50 times per second) calculate the braking force required to avoid a collision. If the estimated braking force exceeds a given level without the driver responding, the danger of a collision is considered imminent and the system automatically reduces throttle input and applies the car's brakes. The system is designed for speeds below 20 mph (30km/h). Active City Stop is available in Europe on the Ford Kuga, Focus, Fiesta and C-MAX.

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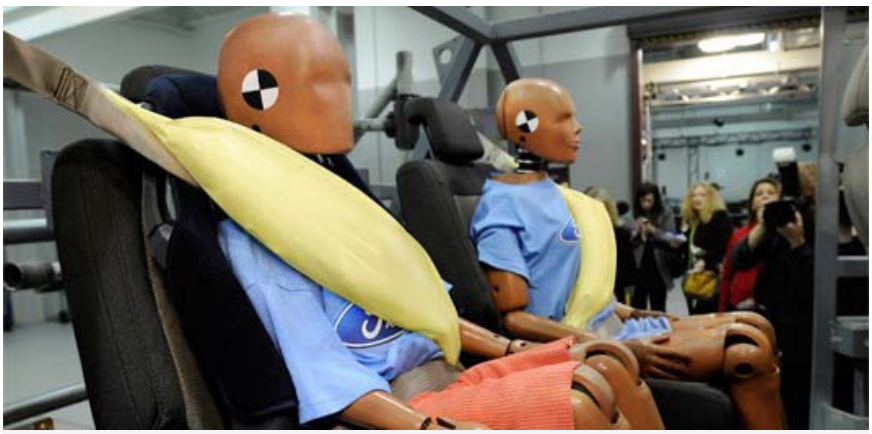
Occupant Protection Technologies

Many factors influence a vehicle's crash performance, including the design of the vehicle's structure (i.e., its ability to absorb impact energy) and the use of passive safety equipment such as air bags to supplement safety belts. Ford's commitment to advancing the state-of-the-art in vehicle safety includes research and development of technologies that further enhance occupant protection in a wide variety of crash circumstances.

For example, Ford is using more advanced and ultra-high-strength steels than ever, as well as researching other advanced materials. Increased use of these materials helps us design vehicle structures with enhanced crash energy management while minimizing vehicle weight – even as we add more features, equipment and safety devices. For example, the all-new Ford B-MAX in Europe uses 58 percent high-strength steels in its body shell and doors. Similarly, in the U.S., the body structure of the Ford Focus is constructed of 55 percent high-strength materials.



Ford inflatable safety belts combine the attributes of traditional safety belt and air bag technologies to help further reduce the risk of head, neck and chest injuries for rear-seat passengers.

For the vehicles of tomorrow, Ford is conducting extensive research into the potential use of other advanced materials (e.g., aluminum, magnesium and composites, among others) in our vehicle architectures. Use of these types of materials will enable us to further reduce vehicle weight while maintaining our commitment to high-levels of occupant protection in a wide variety of real-world crash conditions.

Safety belts remain the most important vehicle safety technology available. In the 2011 model year, Ford brought to market the world's first automotive rear inflatable safety belts, which resulted in several prestigious awards for technological achievement. The rear inflatable safety belts combine the attributes of traditional safety belt and air bag technologies to help further reduce the risk of head, neck and chest injuries for rear-seat passengers.

Rear inflatable belts are designed to deploy over a vehicle occupant's torso and shoulder in less than 40 milliseconds in the event of a crash. Each belt's tubular air bag inflates with cold compressed gas. The inflatable belt distributes crash force energy across the occupant's torso, helping to further reduce the risk of injury. In everyday use, the inflatable belts operate like conventional safety belts and are safe and compatible with infant and child safety car and booster seats. In Ford's research, more than 90 percent of those who tested the inflatable safety belts found them to be similar to, or more comfortable than, a conventional belt.

Rear-seat inflatable safety belts are available in North America on the 2013 Ford Explorer, Ford Flex, Lincoln MKT and Lincoln MKZ. Plans are in place to introduce them into other markets as well.

Related links

Vehicle Websites

- Ford Focus
- Ford Fusion
- Ford C-MAX
- Ford Taurus
- Ford Mustang
- Ford Flex
- Ford Escape
- Ford Edge
- Ford Explorer
- Ford F-150
- Lincoln MKZ
- Lincoln MKX
- Lincoln MKS
- Lincoln MKT

Finally, Ford's Personal Safety System™ is a network of components that, during frontal collisions, can adapt the deployment strategy of the front airbags to the crash severity and occupant conditions. The system's restraint control module (RCM) translates information collected by the front crash sensors, front outboard safety belt buckle switches, driver-seat track position and passenger seat weight sensor. Using this information, the RCM activates the safety belt pretensioners and determines how the dual-stage front airbags will deploy, adapting the release of the airbags to the size and position of the front seat occupants. In North America, the Personal Safety System is standard on nearly all Ford and Lincoln vehicles, including the 2013 Ford C-MAX, Edge, Escape, Explorer, F-150, Flex, Focus, Fusion, Mustang and Taurus and the Lincoln MKS, MKT, MKX and MKZ.

Post-Crash Response Technologies

One method of assisting emergency responders to reach the scene of a vehicle crash quickly is through in-vehicle emergency call systems, also called post-crash notification. These systems can help occupants to summon assistance in an urgent situation.

Ford SYNC® has this capability, for instance. SYNC is Ford's in-car connectivity system that provides a way for drivers to use cell phones and MP3 players through voice commands while keeping their eyes on the road and hands on the wheel. SYNC-equipped vehicles in the U.S., Europe and now China come with an occupant communications capability called SYNC 911 Assist (in the U.S.) or Emergency Assistance (in Europe and China). This is a non-subscription call-for-help system. In the event of a severe crash, the ability to directly contact the local emergency operator could be critical, for both the vehicle occupants and first responders. While any cell phone alone could be used in an emergency situation, SYNC can assist in placing a call to a local emergency operator – when a phone is properly paired, turned on and connected to SYNC and where the system and cell phone remain powered and undamaged – should a crash with an air bag deployment or fuel shutoff switch activation occur. SYNC gives the occupants a choice as to whether or not to make the emergency call, and places the call if the occupant does not respond after a short time. In Europe, Emergency Assistance alerts local emergency services operators in the correct language for the region. In 2012, Emergency Assistance was introduced in China on the all-new Ford Kuga, where it recognizes and responds in Mandarin. The introduction of the Mandarin version in China will help take Ford a step further toward our target of 13 million SYNC customers worldwide.

The SOS-Post Crash Alert System, which is standard equipment on most Ford and Lincoln vehicles, is another advance in post-crash safety technology. The SOS-Post Crash Alert System automatically activates the horn and emergency flashers in the event of an air bag deployment or safety belt pre-tensioner activation. The second-generation system – introduced in the 2011 model year – also is designed to automatically unlock vehicle doors subsequent to an air bag deployment or safety belt pretensioner activation, to aid in rescue. The system is designed to alert passersby and emergency services to the vehicle's location.

Collaborative Efforts

Ford Motor Company continues to collaborate with other automotive companies on precompetitive safety projects to enhance the safety of the driving experience and develop future technologies. The connected vehicles case study describes several of these collaborations, including the Crash Avoidance Metrics Partnership and Vehicle Infrastructure Integration Consortium, among others. This section includes three other major examples: the U.S. Council for Automotive Research, the National Science Foundation's Center for Child Injury Prevention Studies, and our university partnerships.

ON THIS PAGE

Related links

This Report

- Case Study: Connected Vehicles

External Websites

- U.S. Council for Automotive Research
- Center for Child Injury Prevention Studies

U.S. Council for Automotive Research (USCAR)

Ford collaborates with General Motors and Chrysler through USCAR's various safety-related working groups, committees and councils. These include the Safety Technical Leadership Council (Safety TLC), the Occupant Safety Research Partnership (OSRP) and the Crash Safety Working Group (CSWG).

In 2011 and 2012, the OSRP completed a series of evaluations on BioRID, a crash-test dummy that has been proposed for use in a Global Technical Regulation[1] for rear-impact testing. In these evaluations, OSRP engineers assessed the dummy design's "repeatability" and "reproducibility" (R&R), which are essential characteristics for helping to ensure that a crash-test dummy is a reasonable scientific tool. (Repeatability refers to the ability of a single dummy to produce the same results when tested under nominally identical test conditions. Reproducibility refers to the ability of different dummies of the same design to produce the same results when tested under nominally identical test conditions.) If the dummy were to lack R&R, member companies would need to adopt larger compliance margins and conduct more tests to assure compliance with future rear impact regulations. The OSRP working group expects to publish a technical paper with their findings in 2013.

A separate OSRP Pedestrian working group developed a test fixture to enable a study of the repeatability of the FLEX-PLI pedestrian leg form, which is expected to be incorporated into the Global Technical Regulation on pedestrian impact testing. Initial testing of the FLEX-PLI was completed in 2012; additional evaluations will take place in 2013.

The United Nations continues to work toward incorporation of the WorldSID mid-sized male and small female side impact dummies into regulations. Simultaneously, Euro NCAP continues to move toward a new side impact evaluation using the WorldSID mid-sized male dummy. Working group members from the OSRP are participating with representatives from the U.S. National Highway Traffic Safety Administration (NHTSA) and other governments, as well as other automakers, on the evaluation of these dummies and modifications of the designs, to ensure they meet government testing requirements as well as automakers' needs for repeatability, reproducibility, biofidelity and overall usability.

The CSWG conducts and directs precompetitive research on crash-related safety issues, with a current focus on issues associated with aspects of advanced, alternate-fueled, energy-efficient vehicles. The CSWG recently analyzed standard vehicle crash-test data for front, side and rear impact modes. This study resulted in a technical paper submitted to the 2013 World Congress of the Society for Automotive Engineers for presentation.

Finally, the CSWG, in conjunction with the University of Michigan, completed phase one of a high-

voltage battery modeling project. Experiments were conducted to analyze the structural crush behaviors of inert lithium-ion battery pouch cells. The experimental results and theoretical analyses were used to develop finite element mathematical models. This work resulted in four separate reports on the mechanical behavior and modeling of lithium-ion battery cells.

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National Science Foundation's Center for Child Injury Prevention Studies

Ford continues to support research at the National Science Foundation (NSF) Center for Child Injury Prevention Studies (C-ChIPS) at the Children's Hospital of Philadelphia and University of Pennsylvania. C-ChIPS is an NSF Industry/University Cooperative Research Center. Participants include seven automotive companies, NHTSA, *Consumer Reports*, automotive suppliers, child-seat manufacturers, insurance companies, and a crash-test dummy manufacturer.

In addition to helping fund the work, Ford scientists and engineers help to select the research projects pursued by C-ChIPS researchers each year and even serve as mentors for projects that need automakers' vehicle safety expertise. Current projects include studies quantifying the fit of child safety seats in vehicles, identification of risk factors and scenarios for teen driver crashes that result in injury, and the biomechanical evaluation of the lower extremities of existing pediatric crash-test dummies.

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University Partnerships

Ford collaborates with university partners on a wide range of research projects, including research into advanced safety technologies. In recent years, we have fine-tuned the objectives of our grant-providing University Research Program (URP), moving away from pure exploratory and long-term research and toward highly collaborative projects focused on innovations with more near- and mid-term implementation potential.

In 2012, Ford awarded 20 new URP grants to 18 universities around the globe. Recipient schools in the United States included Wayne State University, Michigan State University, University of California – Davis, Georgetown University, Ohio State University and University of Michigan.

In Europe, new URP grants were awarded to RWTH Aachen University and the University of Bayreuth in Germany; University of Twente and Utrecht University in The Netherlands; and Koç University in Turkey.

And in the Asia Pacific region, grants were awarded to the University of Science and Technology Beijing, Nanjing University of Aeronautics and Astronautics, Shanghai Jiao Tong University, and Tsinghua University, all in China. Other universities in this region to win awards included the Indian Institute of Technology in Madras, and the Australian National University in Canberra.

Ford also has major research alliances with the Massachusetts Institute of Technology, the University of Michigan, Stanford University and RWTH Aachen University in Germany, as well as previously awarded URPs with other universities. So, the new Ford URP collaborations add to an active research portfolio that now totals 53 projects in partnership with 35 universities globally. In 2013, we expect to award collaborative URP projects to more universities globally, covering a wide spectrum of research and technology areas.

Safety and sustainability are thrust areas in many of these collaborative university programs. The research catalyzes innovation at Ford by providing access to leading researchers at the cutting edge of biomechanics and passive safety technologies, vehicle dynamics and stability control, accident avoidance and driver assistance technologies, biofuels, emissions reduction, weight reduction, battery and alternative powertrain technologies. Ford will continue to integrate these collaborative innovations into our vehicles, driving continuous improvement in real-world safety and sustainability for all Ford Motor Company products.

The following are specific examples of current safety-related projects sponsored by Ford's Global Research and Advanced Engineering Organization:

- Wayne State University's Bioengineering Department is evaluating surrogates for child lateral impact crash testing. Child crash-test dummies for side impact evaluation of vehicles are a

recent development. Their designs are based on scaling from adults, but children have unique biomechanical properties and are not just small adults. This project seeks to understand how the new child crash-test dummies perform in simulated side impact crashes and how to improve their design.

- RWTH Aachen University is working on the development of advanced crash simulation methodology. This research seeks new methods to predict and accurately assess the crash performance of vehicle structures made with advanced materials.

- Tianjin University of Science and Technology is helping Ford to develop the world's first human body mathematical model of a six-year-old child. Data from CT scans of a representative six-year-old child were used to determine the physical geometry of the skeleton and internal organs. This data was then used to develop a mathematical representation in the virtual world of a human six-year-old child. When completed, this model may help Ford scientists and engineers better understand how injury to children occurs in vehicle crashes and research ways to reduce risk of injury to children in those crashes.

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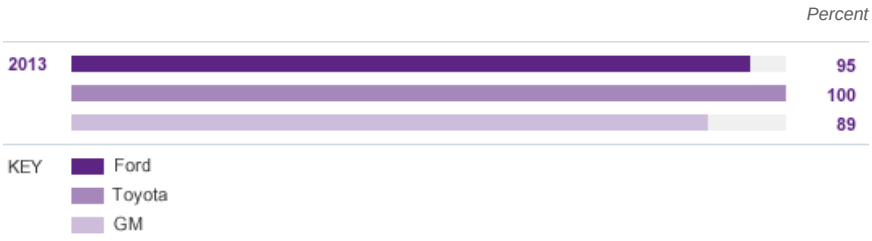
1. Two systems of vehicle regulation predominate globally: the United Nations Economic Commission for Europe Regulations and the U.S. Federal Motor Vehicle Safety Standards. With the aim of harmonizing world vehicle regulations, 31 countries are working together to develop Global Technical Regulations. Ford actively participates in the GTR development process.

Data

DATA ON THIS PAGE

A. Percent of Nameplates Achieving 4-Star or Better NCAP Overall Vehicle Score (OVS)

Data are for the model year noted.



	2013
Ford	95
Toyota	100
GM	89

Third party rated (NHTSA)

Notes to Data

Beginning with the 2011 model year the National Highway Traffic Safety Administration (NHTSA) significantly changed its New Car Assessment Program (NCAP) and added a new metric, the Overall Vehicle Score (OVS), a calculation based on data from frontal crash, side crash, and rollover evaluations. We are simplifying our metrics and reporting NHTSA's OVS. For detailed information on the NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

Related Links

This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

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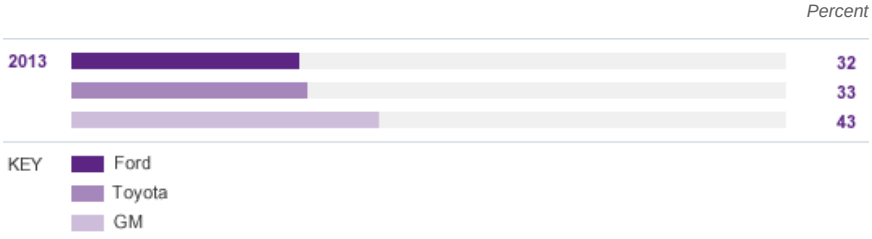
B. Percent of Nameplates Achieving 5-Star NCAP Overall Vehicle Score (OVS)

Data are for the model year noted.



	2013
Ford	32
Toyota	33
GM	43

Third party rated (NHTSA)

Notes to Data

Beginning with the 2011 model year the National Highway Traffic Safety Administration (NHTSA) significantly changed its New Car Assessment Program (NCAP) and added a new metric, the Overall Vehicle Score (OVS), a calculation based on data from frontal crash, side crash, and rollover evaluations. We are simplifying our metrics and reporting NHTSA's OVS. For detailed information on the NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

Related Links

This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

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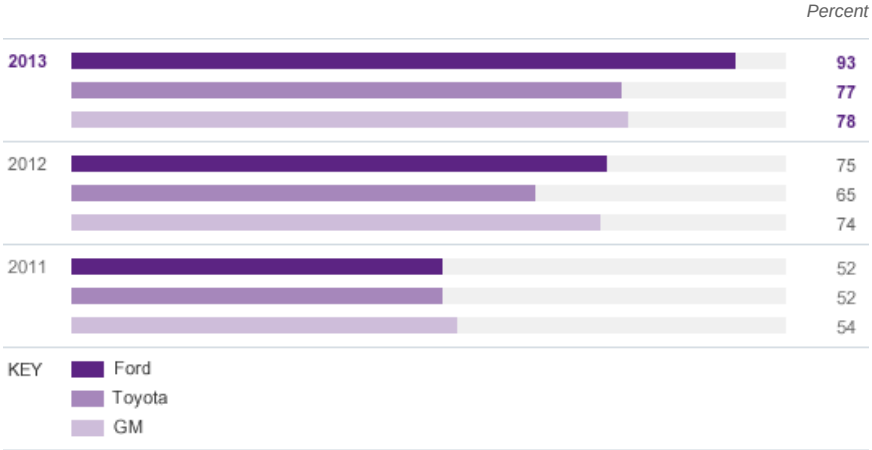
C. Percent of Nameplates Achieving IIHS Top Safety Pick by Manufacturer

Data are for the model year noted.



	2011	2012	2013
Ford	52	75	93
Toyota	52	65	77
GM	54	74	78

Third party rated (IIHS)

Notes to Data

To earn an Insurance Institute for Highway Safety (IIHS) Top Safety Pick (TSP), a vehicle must receive "good" ratings in front, side, roof strength, and head restraint assessments. In 2013, IIHS began awarding Top Safety Pick+ (TSP+) for vehicles earning good ratings in all four of the above-mentioned evaluations plus at least an "acceptable" rating in a new small overlap frontal crash. In addition to the TSP awards, Ford received two TSP+ awards for 2013 MY vehicles. For detailed information on the IIHS's testing procedures, see http://www.iihs.org/ratings/.

Related Links

This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

External Websites:

- IIHS

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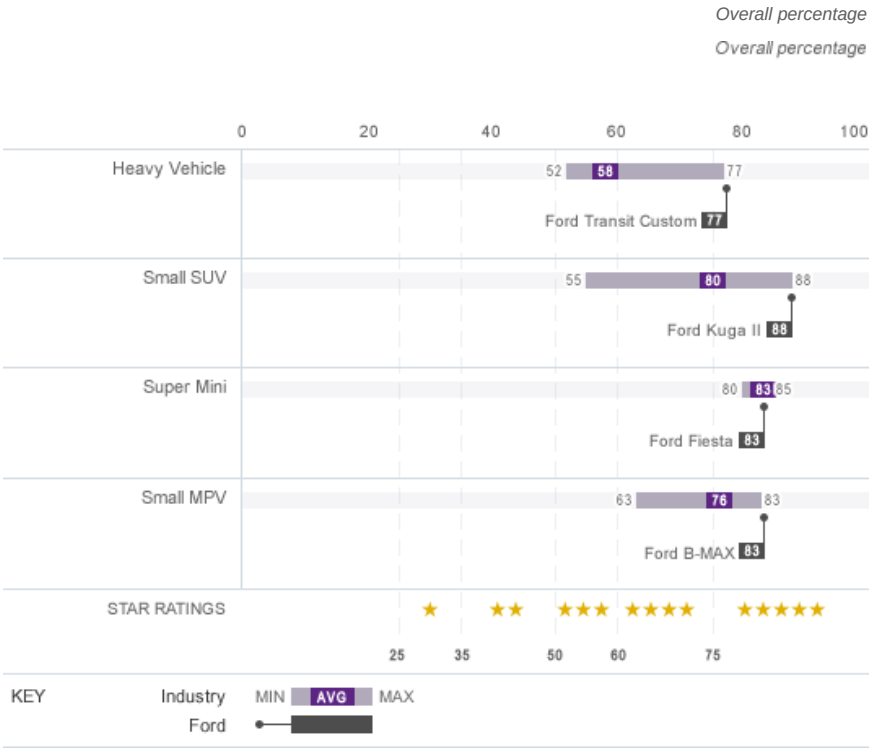
D. Euro NCAP (2012 Ratings)



	Industry Low	Industry High	Industry Average	Ford results
Heavy Vehicle	52	77	58	Ford Transit Custom: 77%
Small SUV	55	88	80	Ford Kuga II: 88%
Super Mini	80	85	83	Ford Fiesta: 83%
Small MPV	63	83	76	Ford B-MAX: 83%

Third party rated (Euro NCAP)

Notes to Data

EuroNCAP combines all assessed criteria to an overall “fulfillment percentage” ranging from 0 percent to 100 percent. Star ratings are dependent on the fulfillment percentage. Currently a 75 percent or higher is required for a 5-star rating. In addition to the star ratings, five Ford vehicles received “Euro NCAP Advanced” rewards for new safety technologies in the 2012 ratings. For additional information, go to www.euroncap.com.

Related Links

This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

External Websites:

- Euro NCAP

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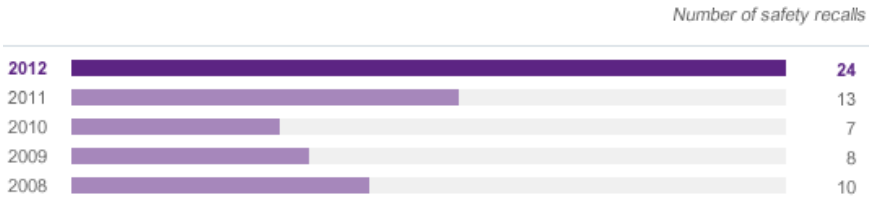
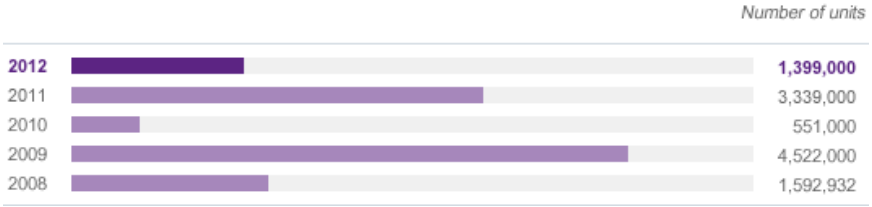
E. U.S. Safety Recalls





	2008	2009	2010	2011	2012
Number of safety recalls	10	8	7	13	24
Number of units	1,592,932	4,522,000	551,000	3,339,000	1,399,000

Reported to regulatory authorities (NHTSA)

Notes to Data

Three of the 2012 calendar year safety recalls were reported by NHTSA in January 2012, although they were approved by the Company in December 2011. Additionally, three other 2012 calendar year safety recalls were supplements to safety recalls that were originally approved by the Company in 2010 and 2011.

Related Links

This Report:

- Vehicle Safety and Driver Assist Technologies

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Case Studies

IN THIS SECTION

Case Study: Connected Vehicles

In the future, vehicle technologies will allow cars to communicate wirelessly with one another and with roadway infrastructure using advanced Wi-Fi signals or dedicated short-range communications. Learn about Ford technologies that are already showing what is possible in the realm of connected vehicles, as well as collaborative research we are undertaking with others to help the vision become reality.

Case Study: Public Domain Ratings

Public domain rating programs that perform vehicle crash testing and other assessments, which differ around the world, have regularly updated their testing protocols and evaluation criteria. Read about the changes that several of these programs have made over the past two years – changes that are making it increasingly difficult to achieve the highest ratings, even though vehicles are safer than ever.

Case Study: Electrified Vehicle Safety

Because hybrids, plug-in hybrids and pure battery electric vehicles contain a high-voltage battery, first responders – the firefighters, police officers and emergency medical technicians who show up at the scene of a crash site – need some special knowledge and skills to be able to safely address a vehicle crash involving an these vehicles. Read what Ford is doing to help educate first responders.

Case Study:

Connected Vehicles

Imagine a future in which vehicles "talk" to each other – and to stoplights, other transportation infrastructure and even pedestrians and bicycles – in a way that might have seemed like science-fiction fantasy just a few decades ago. In this future, vehicle technologies will allow cars to communicate wirelessly with one another using advanced Wi-Fi signals or dedicated short-range communications on secured channels. The Wi-Fi-based radio system will allow 360 degrees of detection, so it can "look" around corners for potentially dangerous situations, such as when a driver's vision is obstructed.

Such connected vehicles could warn drivers if there is a risk of collision when changing lanes or approaching a stationary or parked vehicle, or if another driver loses control. Drivers also could be alerted if their vehicle is on a path to collide with another vehicle at an intersection, when a vehicle ahead stops or slows suddenly, or when a traffic pattern changes on a busy highway.

By potentially reducing collisions, connected vehicles could also ease traffic delays, which could save drivers both time and fuel, thereby reducing their environmental impacts. Traffic congestion also could be avoided through a network of connected vehicles and infrastructure that processes traffic and road information. A traffic management center would send this information to connected vehicles, which could then suggest less-congested routes to drivers and other connected travelers.

Already, Ford has unveiled an array of accident avoidance and driver assist technologies that use radars and cameras to warn the driver of a potentially dangerous situation, and in some cases provide assistance to the driver. And we are taking part in numerous research projects – on our own and in cooperation with other companies and government bodies – to develop and demonstrate other technologies.

Ford Technologies

Technology and innovation are the fundamental drivers for Ford Motor Company's Blueprint for Mobility. As our Executive Chairman, Bill Ford, mentioned in a 2012 speech in Barcelona, in the next five years consumers will see the migration of driver assistance technologies across our product lineup. These technologies include radar-based systems such as Adaptive Cruise Control and the Blind Spot Information System, as well as camera-based technologies such as Traffic Sign Recognition and Lane Keeping Assist. In addition, we will begin investigating new models of car use, such as car and ride sharing, and developing new partnerships that will help us connect with consumer trends.

Our Lane Keeping System uses a small, forward-facing camera behind the inside rearview mirror to "look" down the road, monitor lane lines to determine that the vehicle is on course.

Related links

This Report

- Our Blueprint for Mobility
- Accident Avoidance and Driver Assist Technologies

External Websites

- DRIVE C2X
- EuroFOT
- interactIVe
- National Highway Traffic Safety Administration
- Vehicle Infrastructure Integration Consortium

In the midterm, our vision is to enhance driver assistance technologies to include more semi-automated capabilities. These capabilities will give drivers the option to let the car take the lead in certain situations, such as when changing lanes, in traffic jams or on freeway trips. The driver will always be able to take back control, if needed.

In the long term, we hope consumers will begin to see a radically different transportation system, particularly in urban centers. Cars will be connected to each other, as well as to the infrastructure around them. Vehicles will take in a significant amount of information that will allow them to have automated capability, such as parking themselves or driving in connected groups on the freeway. There will also be seamless connections between different modes of transportation, from personal cars to public transit systems to parking facilities at businesses.

In order to reach our future mobility vision, we recognize that no single automaker or even groups of automakers can do it alone. That is why we are working on collaborative research to make our vision a reality.

Collaborative Research

The U.S. Department of Transportation (USDOT) is leading research and coordinating two automaker coalitions relating to connected vehicles. The first coalition is the Crash Avoidance Metrics Partnership (CAMP), a group of eight automakers that focuses on the technical aspects of connected vehicles; the second is the Vehicle Infrastructure Integration Consortium (VIIC), a group of nine automakers that focuses on the policy aspects of connected vehicles.

CAMP is working on the technical standards necessary for all the motorized vehicles on the connected vehicle network to be interoperable. This technical partnership included the world's first government-sponsored driving clinics in 2011 and expanded to include a year-long field trial. The field trial started in August 2012 in Ann Arbor, Michigan, and includes data collection on approximately 3,000 vehicles that are communicating with each other. The goal is to complete the research phase in 2013.

The VIIC is working on the significant practical and policy challenges, such as security, privacy and the allocation of risk and liability, that will need to be addressed before Ford's vision of a connected vehicle network can become a reality.

Even though we do not have all of the solutions today, Ford is committed to work with the USDOT through the public/private partnerships at CAMP and VIIC to address these challenges.

In Europe, the "Safe Intelligent Mobility – Test Field Germany" (known as "simTD" for short) is investigating vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications under everyday conditions in a large-scale field operational test. In simTD, 120 vehicles were outfitted with V2V and V2I communications systems, and roadside units were set up in select locations around the test area. Both were also linked up to traffic control centers. During the test, which took place from July to December 2012 in and around Frankfurt, Germany, participating drivers received information about traffic jams and road accidents, so they could choose alternate routes. More than 350 drivers actively participated and collected data by completing specific driving tasks. In total, the test vehicles drove more than 400,000 kilometers and collected about 30 terabytes of log data, which is now being evaluated.

Ford provided 20 specially equipped Ford S-MAX models for use as test vehicles in the simTD project. Ford is also leading the development, testing and evaluation of the Electronic Emergency Brake Light system, which warns the driver of a heavily braking vehicle ahead. The simTD project will wrap up in 2013. It is a joint effort with other vehicle manufacturers, suppliers, telecommunication providers and research institutes, as well as public authorities. It receives partial funding from the German government.

Ford is also contributing to the European harmonization and standardization of wireless communication systems and applications within the framework of the DRIVE C2X project, which is co-funded by the European Commission. DRIVE C2X is the acronym for "DRIVing implementation and Evaluation of C2X communication technology in Europe" (C2X refers to "car-to-car and car-to-infrastructure" communication, and means the same as V2V and V2I). This project kicked off in January 2011 and is planned to run until mid-2014. It brings together more than 40 stakeholders, such as vehicle manufacturers, suppliers, universities and public authorities from all over Europe. Within the framework of DRIVE C2X, field operational tests in a real-world environment are being conducted in seven test sites across Europe.

In 2012, DRIVE C2X achieved a major milestone – the successful implementation of a European V2X reference system at the test site in Helmond, the Netherlands. Also, cooperative driver awareness and warning functions have successfully been demonstrated to the European Commission and invited technical executives. The DRIVE C2X system was also demonstrated at a "Cooperative Mobility Demonstration" that took place at the ITS World Congress in October 2012 in

Vienna, Austria.

Both simTD and DRIVE C2X are working to pave the way for the full deployment of V2V and V2I systems in Europe, and will provide Ford with some of the data needed to develop next-generation safety and mobility features. However, cooperative systems can only be deployed successfully in cooperation with other automakers and key players such as road operators. Therefore, Ford joined the “CAR 2 CAR Communication Consortium” as a member in January 2013. This association of automakers, suppliers, research institutes and other stakeholders aims for European standardization of V2X technology and supports its deployment.

In January 2010, a consortium of 29 partners – led by the Ford European Research Center in Aachen, Germany – joined forces in the Accident Avoidance by Active Intervention of Intelligent Vehicles (interactIVe) European research project. This consortium seeks to support the development and implementation of accident avoidance systems, and consists of seven automotive manufacturers, six suppliers, 14 research institutes and three other stakeholders. The European Commission is covering more than half of the €30 million budget.

During the planned 42-month duration of interactIVe, the partners are testing the performance of implemented safety systems through active intervention, including automated braking and steering in critical situations, with the aim of avoiding collisions or at least mitigating impact severity in accidents.

In 2012 we completed another major European research project (called EuroFOT) that served as a large-scale field operational test of the real-world impact of accident avoidance systems. Under the EU’s Seventh Framework Program (FP7) for research and technological development, this project joined together 28 partners – including vehicle manufacturers, suppliers, universities and research centers. More than 1,500 cars and trucks were equipped with eight technologies, along with advanced data-collection capabilities. This allowed a thorough evaluation of the new technologies for safety, efficiency and driver comfort, in real-world scenarios and with ordinary drivers. The project had a total budget of €22 million and was led by the Ford research center in Aachen, Germany. It included 100 Ford vehicles.

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Case Study:

Public Domain Ratings

Safety regulations and public domain rating programs differ around the world, and they are constantly evolving in response to various regional factors. The public domain rating programs that perform vehicle crash testing and other assessments have regularly updated their testing protocols and evaluation criteria to reflect the needs of the region. In the past two years, several of these programs have markedly revised their vehicle rating systems, making it increasingly difficult to achieve the highest ratings. The changes have also caused the testing protocols to become even more inconsistent and divergent between regions. Some of the changes include the addition of new assessment items (such as different-sized dummies in different seating positions), different or more-stringent crash evaluation criteria and greater emphasis on accident avoidance and driver assist features. A major challenge for a global automotive company like Ford is that the complexities of these evolving programs may initiate a demand for different vehicle technology offerings in different markets.

In addition, New Car Assessment Program (NCAP) systems are being launched in regions where they have not existed in the past. This is partly due to the influence of a new nonprofit organization based in London called Global NCAP that is promoting the establishment of NCAPs around the world. They have already helped to develop a Latin NCAP system, which is now rating vehicles in Mexico and South and Central America. In 2012, a new ASEAN NCAP was launched in Malaysia.

In the U.S., the NCAP program of the U.S. National Highway Traffic Safety Administration (NHTSA) includes a 35 mph (56 km/h) full frontal impact test, a side impact test consisting of a moving barrier and a rigid pole, and a static stability rating. NHTSA also provides an overall vehicle score (a “star” rating, from one to five stars) representing a combination of the vehicle’s front, side and rollover ratings.

Evaluations conducted by the Insurance Institute for Highway Safety (IIHS) include a 40 mph (64 km/h) frontal offset (40 percent overlap) crash test, a side crash test with a higher barrier, a roof strength test, plus evaluations of head restraints in a rear-impact simulation. To earn a Top Safety Pick from the IIHS, a vehicle must receive “good” ratings in the front, side, roof and head restraint assessments. Beginning in the 2013 program, the IIHS added a small (25 percent) overlap frontal test, simulating minimum engagement or an impact with a narrow object, to their Top Safety Pick rating system. Vehicles that perform at a “good” or “acceptable” level in this new small offset test will earn an IIHS Top Safety Pick+ award. The IIHS will allow vehicles that are currently Top Safety Picks to keep that award during the phase-in period, which is expected to last several years.

Euro NCAP conducts a 64 km/h (40 mph) frontal offset (40 percent overlap) crash, a side crash and a side pole impact, as well as pedestrian protection and child safety evaluations. Recent changes to the Euro NCAP include the addition of a test for whiplash neck injury protection in rear impact, and rewards for speed limiters and the inclusion of electronic stability control technologies as standard features. Like NHTSA, Euro NCAP also gives each vehicle an overall star rating representing a combination of individual assessments. In addition to publishing the main vehicle ratings, Euro NCAP has added an Advanced Rewards program to recognize certain safety and accident avoidance technologies that are not currently rated under their protocols. Euro NCAP has also announced significant changes to its rating system between 2014 and 2016. These changes are far-reaching and include a stronger focus on accident avoidance and driver assist features, new and revised crash tests and dummies, and changes to the assessments for pedestrian and child safety. (See Voice: Dr. Michiel van Ratingen for comments from the Euro NCAP Secretary General.)

The emerging testing and assessment methods being developed by Global NCAP are based on existing protocols – typically those from Euro NCAP. Latin NCAP announced changes to their program for 2013. The changes are quite significant and affect areas such as child restraints, child dummies, applicability of the ratings, fitment rates for safety equipment, seat belt reminders and

Related links

External Websites

- Australasian New Car Assessment Program
- China New Car Assessment Program
- European New Car Assessment Programme
- Global New Car Assessment Programme
- Insurance Institute for Highway Safety
- Latin New Car Assessment Program
- U.S. National Highway Traffic Safety Administration

new requirements for five-star ratings. In addition, revisions to the China and Australasian NCAP programs are planned in stages and began taking effect in 2011. In 2012, changes to China NCAP include increasing the offset frontal impact test speed from 56 km/h to 64 km/h, the introduction of whiplash assessments and the inclusion of rear dummy assessments in the ratings. The Australasian NCAP has published a rolling, five-year “road map” detailing changes they plan to introduce through to the end of 2017. These include whiplash and roof-strength assessments and increased requirements for accident avoidance and driver assist technologies.

Thus, even though Ford vehicles are safer than ever, individual vehicle crash ratings achieved for the 2011 model year and beyond should not be compared to ratings achieved prior to 2011. (See the Data page.)

In addition, while some of the basic test methods are similar in the global evaluation programs, each program varies in the ways in which vehicle ratings are determined. This means that for an identical car, achieving the highest rating in one region or evaluation program does not guarantee the same result in another region or program.

Just as rating programs vary by region, so do regulations, road infrastructure, the competitive landscape and other factors that can influence real-world safety. We work to understand all of these variables and to deploy and offer safety features that meet the needs of the region. And we continue to invest in new technologies to prepare for future societal needs. At Ford, we strive to make technology available on a wide range of our products, even as we remain competitive in the markets in which Ford vehicles are sold. This approach promotes greater societal benefits through broad market acceptance of new technologies, which ultimately improves real-world safety.

Case Study:

Electrified Vehicle Safety

Anyone who owns an electrified vehicle (EV) can attest that the experience of driving an EV is essentially the same as that of a "regular" vehicle powered by an internal combustion engine. Certainly no special skills are needed to operate EVs such as hybrids, plug-in hybrids or pure battery electric vehicles.

Under the hood, however, EVs are, in fact, different from non-electrified vehicles in at least one important respect: they contain a battery with 300+ volts of power, whereas a regular vehicle has just one 12-volt battery.

And that means that first responders – the firefighters, police officers and emergency medical technicians who show up at the scene of a crash site – may indeed need some special knowledge and skills to be able to safely address a vehicle crash involving an EV.

"It's not uncommon for first responders to need to update their skills and procedures in response to new technologies," said Domenico Gabrielli, vehicle safety engineer in Ford's Automotive Safety Office. "For instance, the advent of high-strength steels and new types of airbags required a modification of tools and procedures. Likewise, in recent years the industry has been focused on educating first responders about EVs."

For example, we and other EV manufacturers have developed special Emergency Responder Guides for each of our electric vehicles. These guides include information on how to identify a Ford EV, locate the high-voltage system, disconnect it, and move and store the disabled vehicle, among other key tasks. Also, over the years, we have actively supported firefighters' hands-on crash-response procedure training events, through the donation of EVs and the attendance of Ford technical personnel.

In 2010, we began working with the National Fire Protection Association (NFPA) to help reach more first responders and educate them about electric vehicles. We take part in conferences on the topic that are jointly hosted by the NFPA and the Society for Automotive Engineers (SAE). We also solicited (and incorporated) the NFPA's feedback on our Emergency Responder Guides.

The NFPA has since developed a website for first responders, where our and other automakers' guides are housed. Also, the NFPA developed the Emergency Field Guide – a quick reference guide that summarizes the key information that first responders need for all makes and models of EVs.

"Our comprehensive training programs – both classroom-based and online – have reached at least 35,000 first responders," said Andrew Klock, senior project manager at the NFPA. "And the classroom programs are 'train-the-trainer' courses, so we know the lessons taught there are being cascaded out to many, many more first responders."

The NFPA is also working with the Fire Protection Research Foundation, which is currently conducting a study on high-voltage battery fires and best practices for extinguishment. That work is funded in part by the Alliance of Automobile Manufacturers, of which we are a member.

Ford has also been involved in the SAE's efforts to develop recommended standard procedures for first responders regarding EVs involved in crashes. Several Ford engineers served on the committee that developed the procedures, which were published in February 2013.

"It's important to note," said Gabrielli, "that automakers and government regulatory agencies have worked hard to ensure that EVs are safe in the event of a crash." All EVs in the U.S., for instance, must comply with the National Highway Traffic Safety Administration's regulations governing the safety of EVs. Ford also complies with similar regulations in force in other countries around the world.

Ford also has internal guidelines for EVs, governing all aspects of battery safety and crash protection. In our EVs, for example, the high-voltage battery is housed in a strong steel casing,

Related links

This Report

- Electrification: A Closer Look

External Websites

- National Fire Protection Association
- Society for Automotive Engineers

which helps to provide protection in addition to the car's overall safety structure. "From the beginning, our electrified vehicles are designed for safety," said Gabrielli.

First responders have long been used to addressing the risks associated with "regular" vehicle crashes, which may involve the spillage of large quantities of flammable liquid. EVs have unique issues that first responders also need to learn how to handle. But we're confident that the efforts of Ford and others in the industry are helping to ensure that first responders have the information they need to do their jobs safely.

Dr. Michiel van Ratingen

Secretary General
European New Car Assessment Program (Euro NCAP)

In 2009, we at Euro NCAP released a strategic “road map” for updating European safety standards and consumer testing protocols. As we have implemented the changes outlined in that road map, the auto industry has had a harder time earning five-star vehicle ratings.

The reasons behind our road map were quite simple. In Europe, we had seen a significant increase in the safety of vehicles – to the point where our standards were beginning to fall behind what the automakers were delivering. Consumers and insurance companies told us it appeared to be too easy to receive high ratings. Moreover, we weren’t making any distinction between cars that had new accident avoidance technologies and those that did not. The updated standards, therefore, make it more difficult to achieve five stars while also taking the newer technologies into account.

And, these higher standards have delivered better safety for consumers. One example is in the area of pedestrian safety. In our updated ratings system, the score for pedestrian safety was integrated into the overall star rating, so companies began to pay more attention to it. As a result, we have seen significantly better performance in this area since 2009 than previously.

For the next five years, we will continue to update our tests to keep pace with technology. But we do not anticipate updating at the same rapid pace.

Part of our job at Euro NCAP is to educate consumers about our ratings system and what it means. That’s not simple, because safety is not as sexy a topic as it was 15 years ago. Consumers, today, take safety as a given. In Europe, North America and Japan, in particular, we are spoiled by extremely safe and well-engineered vehicles. So, we work hard to keep safety front-of-mind for consumers, so they continue to consider it in their vehicle purchases.

While our focus is Europe, we have also been supporting Global NCAP and their efforts to bring NCAPs to other regions of the world. The NCAP systems in the developing world, in particular, can’t be exactly as they are in the developed world, because the vehicles and technologies currently offered in those countries are not the same. But we do try to provide the regional programs with technical support, as appropriate.

Going forward, we believe that automakers with a global footprint should be bringing their vehicle safety best practices to other regions more quickly. About one-third of vehicles produced globally today would not meet the most basic frontal crash tests. That needs to change.

In Europe, making continued safety progress is a very different issue. The low-hanging fruit is gone. What’s left is harder to identify, and the costs and benefits are not as clear. We need to focus on smaller topics – such as addressing challenges for aging drivers – in order to make further advancements in safety. We know we will also see more accident avoidance and driver assistance technologies on vehicles. We are confident that automated driving (or partly automated driving) will come to Europe in the next few years.

I want to make clear that our intention is not to put a big burden on the automotive industry. Safety has many aspects (including, for instance, road infrastructure), and automakers can’t address all of them. We know we need to have a continuing dialogue with companies such as Ford about what’s

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realistic and feasible, particularly given the difficult economic times we are experiencing in Europe.

One issue that adds to the burden on car companies is a lack of alignment among all the standards, including those of the various NCAPs and those of the Insurance Institute for Highway Safety in the United States. We all have plans to further develop our standards, and not in the same way. I don't want to see us make the mistake of instituting completely different tests – especially for the new accident avoidance technologies. We should be able to agree on a set of tests for autonomous braking, for example. We have been working on this with the other rating organizations, and we will continue to do so.