Editorial

New Lighting Functions: DVN Study Coming In September

Complex new needs for safety and style have broken the ice toward great innovations in vehicle lighting. That's why DVN started working last January on a study of the new lighting functions likely to appear in the next decade. Our intent with this study is to help executives, engineers, and experts in the vehicle lighting and vision community make the best-informed decisions for application in the 2020-'30 timeframe.

To create the study, we've applied our established methodology including focussed discussions with key stakeholders of the industry, input from leading research institutes, literature review from congresses and workshops, and analysis of the gathered information. Market trends are evaluated in context of the social and industrial environments drastically changed by the Covid pandemic. We conducted 30 interviews with lighting companies, automakers, tier-1 and -2 lighting suppliers, and researchers. I am very thankful to all the participating companies and institutes who shared their valuable opinions and insights on automotive lighting with us. Only with their support were we able to complete this study which will be made available shortly. For more information about price and table of contents, please see **the brochure**.

I personally thank Jean-Paul Ravier, Leo Metzemaekers, Ralf Schäfer, Rainer Neumann, Carsten Befelein, and Daniel Stern for conducting the interviews, and for their professional analysis in writing this report. Geoff Draper did a great job applying his experience in vehicle lighting technology and regulations, and Salomon Berner challenged us to make the report readily accessible for everybody. We're really proud of our work to pack it with value, and we're eager for your feedback once you've read it.

Sincerely yours

DVN PRESIDENT

In Depth Lighting Technology

Sneak Preview: DVN Global Market Study

The last decade was very rich in innovation for vehicle lighting with the ADB breakthrough, quickly followed by more refined matrix versions; the democratisation of LED lighting, new laser and OLED light sources as well as ever-improving LEDs and associated optics and electronics, and the emergence of ambient interior lighting.
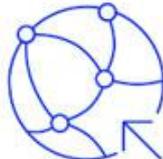
In parallel, the automotive industry as a whole has been undergoing fundamental changes with a focus on four new technology areas known in shorthand as ACES, for **a**utonomous, **c**onnected, **s**hared, and **e**lectric vehicles.

Autonomous driving   Shared mobility   Connectivity   Electrification

In this context, the question arises of how lighting can support and profit from these trends. Therefore R&D in vehicle lighting in recent years has explored new functions with digitalised lighting through high definition systems and road projections. Examples of other areas are display-type exterior lighting as well as new interior lighting functions.

On top of above major changes, the automotive industry has had to cope with the covid-19 pandemic. In case of a realistic scenario of an estimated 30% drop in global vehicle sales for 2020, the value for the 2020 global automotive lighting market would drop to around €22bn. There will be severe tension between an extraordinarily strong management of scarce resources by vehicle makers and big opportunities for adding new lighting functions and research for additional lighting breakthroughs.

The DVN Study

Under these circumstances, the DVN team decided to launch a study on the opportunities and risks the automotive lighting community could face in the decade 2020-2030. The study, entitled **New Lighting Functions 2020-2030**, will cover all important areas of interior and exterior vehicle lighting technology and market developments. More information about price in **the brochure**.
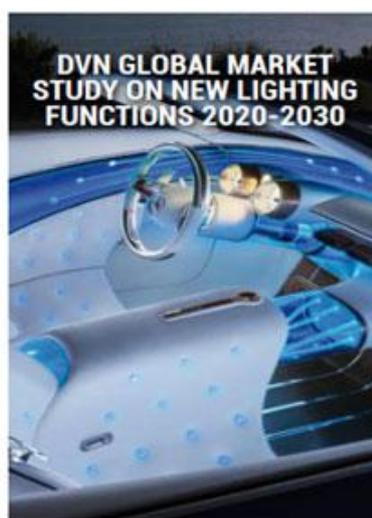
Just a few of the topics investigated are improved safety by dint of of new exterior lighting functions for communication by light; new styling approaches, and new user experience with interior lighting central to connected and cocooning passenger cabins. We've made this study to provide insight into major innovations to come—evaluating their interest, risks, chances to succeed, and regulatory implications. As a main topic, of course, the business challenges and opportunities and market trends are evaluated in context of the social and industrial changes wrought by the pandemic.

To create the study, DVN applied our established methodology:

- Focussed discussions with key industry stakeholders
- Input from leading research institutes
- Literature review

- Analysis of the gathered information
- Sanity-reality checks with experts in the field

The process was directed and driven by eight senior vehicle lighting experts, greatly aided by numerous companies and institutes shown here.

As a general outlook of the study, we see a bright future for the vehicle lighting market despite the challenges of the pandemic. Of course cancellation and delay of projects will occur in next couple of years, but the industry has plenty of new ideas and technologies under development to catch up afterwards and resume advancing and improving safety and style. Digitalisation of light will carry on, with new business models partly based on recurring revenues. Additionally, invisible light (IR and UV) as new application areas can offer attractive business opportunities for pioneering specialists in these sectors.

The intent of the study is to set out a yardstick for a view on development and market introduction of new vehicle lighting functions in the coming decade. A main target is to give the vehicle lighting and vision community a framework and foundation for discussing future prospects. The study will serve decisionmakers and experts along the automotive lighting value chain as a valuable resource for making well-informed strategic decisions about market and business approaches, technology choices, resource allocation and investments.

Content

Lighting News

CarVisionLight: Camera Inside Headlamps

As part of the industrial research project "CarVisionLight", ZKW are coöperating with the Institute of Visual Computing and Human-Centred Technology at the Technical University of Vienna and Emotion-3D. The idea is to understand and apply the interplay between lamps and 3D cameras in ADB systems.

The CarVisionLight project consider image acquisition, image processing and adaptive lighting. It is a central, essential step for the further development of premium vehicle lighting technology. The integration of 3D stereoscopy to capture the surroundings in a control loop with high-resolution headlight technology serves as the cornerstone for the product concept of an overall machine vision system.

Part of the project is the training of night-drive-specific AI algorithms. The experimental system used for this consists of flexibly-conceptualised prototype headlamps incorporating a camera and high-resolution micromirror Z-LED module based on DLP technology; image processing based on artificial intelligence, and an improved ADB light control that takes stereoscopic data into account. An essential part of the project is also the recording of suitable video sequences as training data for the algorithms. It is also crucial to minimise image disturbances, with challenges such as glare and motion blur versus the usual installation behind the windshield.

Compared to current implementations, the depth of information from stereoscopy offers the possibility of significantly improving the lighting control. This can be implemented through model-based development of a function which enables execution on prototype hardware. Dynamic object lists are used instead of a fixed number of objects. The model takes into account separate processing paths for a supporting Segment-Lite-ADB basic lighting system from ZKW and the high-resolution Mirror-Z-LED module that creates the image. This light control realisation is the basis for general product development as well as for the further development of existing product solutions.

Accounting for the various challenges that arise when a camera is in the headlamp, ZKW have developed tests to assess which system is best suited for the project. For automotive cameras, for example, HDR (high dynamic range) cameras and imaging systems provide a very good contrast ratio for image processing.

Vantablack for Unique Vehicle Lighting Designs

At the Frankfurt Motor Show the world's first (and so far only known) vehicle finished in Vantablack$^{®}$ VBx2 coating was shown—a collaboration between BMW and Surrey Nanosystems, whose "Vantablack" is is a range of super-black coatings. The coatings are unique in their hemispherical reflectances below 1%, and they retain this level of performance from all viewing angles. The original coating, known just as Vantablack, holds the independently verified world record as the darkest man-made substance. It was originally developed for satellite-borne blackbody calibration systems and was applied in 2015 to eliminate sun glare in satellite positioning systems operating in space.

Vantablack coatings have unrivalled absorption from ultraviolet frequencies out beyond the terahertz spectral range. The properties of these coatings are being exploited for applications such as deep space imaging, art, æsthetics… and, as **presented** on Surrey Nanosystems' website, automotive sensing and optical systems. The coatings could eliminate unwanted stray light and flare in automotive optical sensors and displays, for example, maintaining system availability and reliability even in extreme lighting conditions.

"Vantablack coatings eliminate reflectances in head up displays and camera glare shields. They significantly boost the performance of lidar sensors and are used to control stray light and to create unique designs in automotive lighting", says Surrey NanoSystems Business Development Director Michael Stellmacher.

Kyocera, Osram Develop µLED Tech for AR Devices
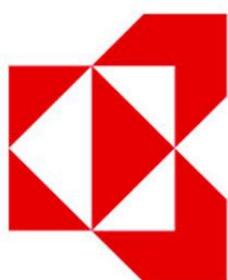
Kyocera and Osram are reportedly working on a new hybrid current and PWM microLED display driving technology. The new strategy can be used to avoid using lower pixel currents through microLED chips, thus reducing luminance deviation and colour shift even at lower grayscale levels.

The new driving technology was demonstrated with Kyocera's 3.9-inch full colour µLED display based on an LTPS backplane. The technology also applied a reflector cavity process to increase the display brightness.
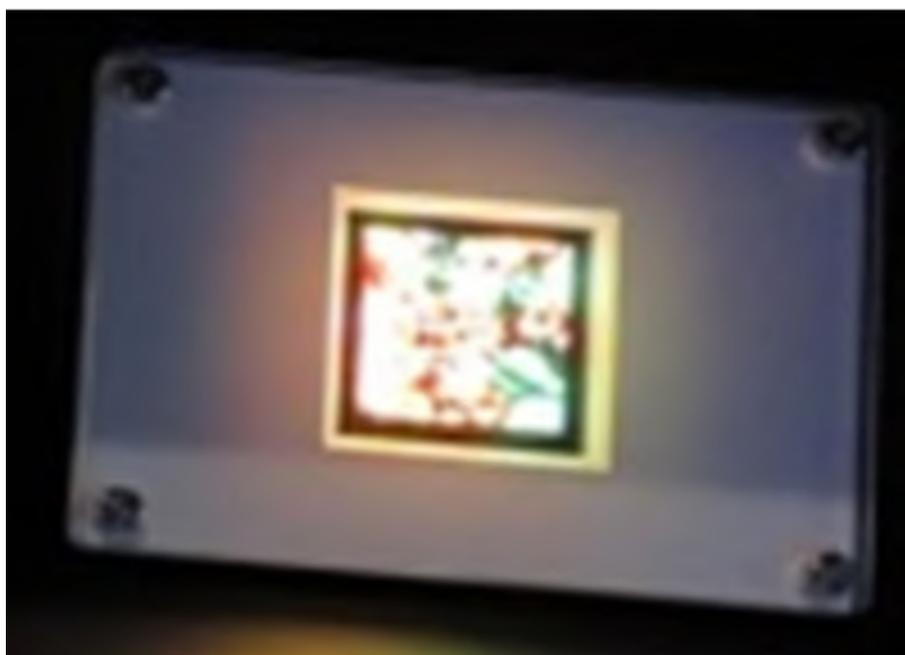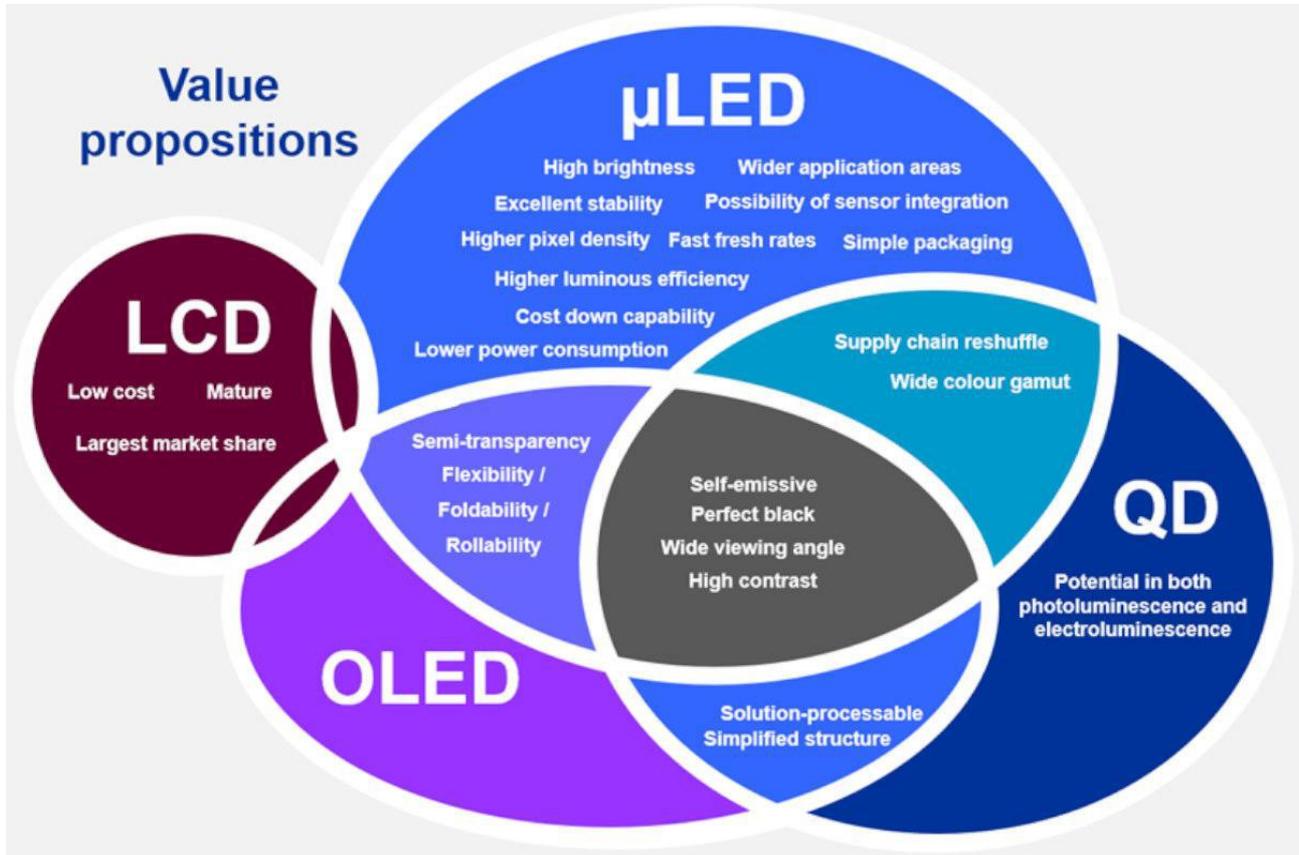

It is said the technology could be used for AR applications with its features of high brightness and advanced colour performance.

Kyocera have been involved in wearable applications based on Micro LED display technology; last year they presented a 1.8-inch µLED display for wearable devices.

Covid-19 Boosts µLED Market

The Covid-19 pandemic could see a key change in the supply chain for display technology, with a boost for microLED displays. That's according to a new report from IDTechEx.

Involving multiple existing industries and new industries, µLED displays may reshape the existing LED and display supply chain—making it longer and more complex. New technology approaches and new products can also provide new opportunities; for example, the CMOS industry could take a position in the µLED display supply chain.

The µLED market will be driven by augmented and mixed reality, virtual reality, large video displays, TVs and monitors, automotive displays, and mobile phones. The increasing number of related activities from display suppliers can be seen from the large cumulative investment of around USD $5bn, the increasing number of patent filings, as well as the prototypes and products brought forth by µLED vendors including AUO, PlayNitride, RiTdisplay, Samsung, LG, Sony, TCL, Tianma, Konka, Glo, Plessey, JBD, X-Display, VueReal, CSOT, Sharp, and Kyocera, amongst others.

Driver Assistance News

Velodyne Lidar + Kaarta Cloud = Stunning 3D Maps
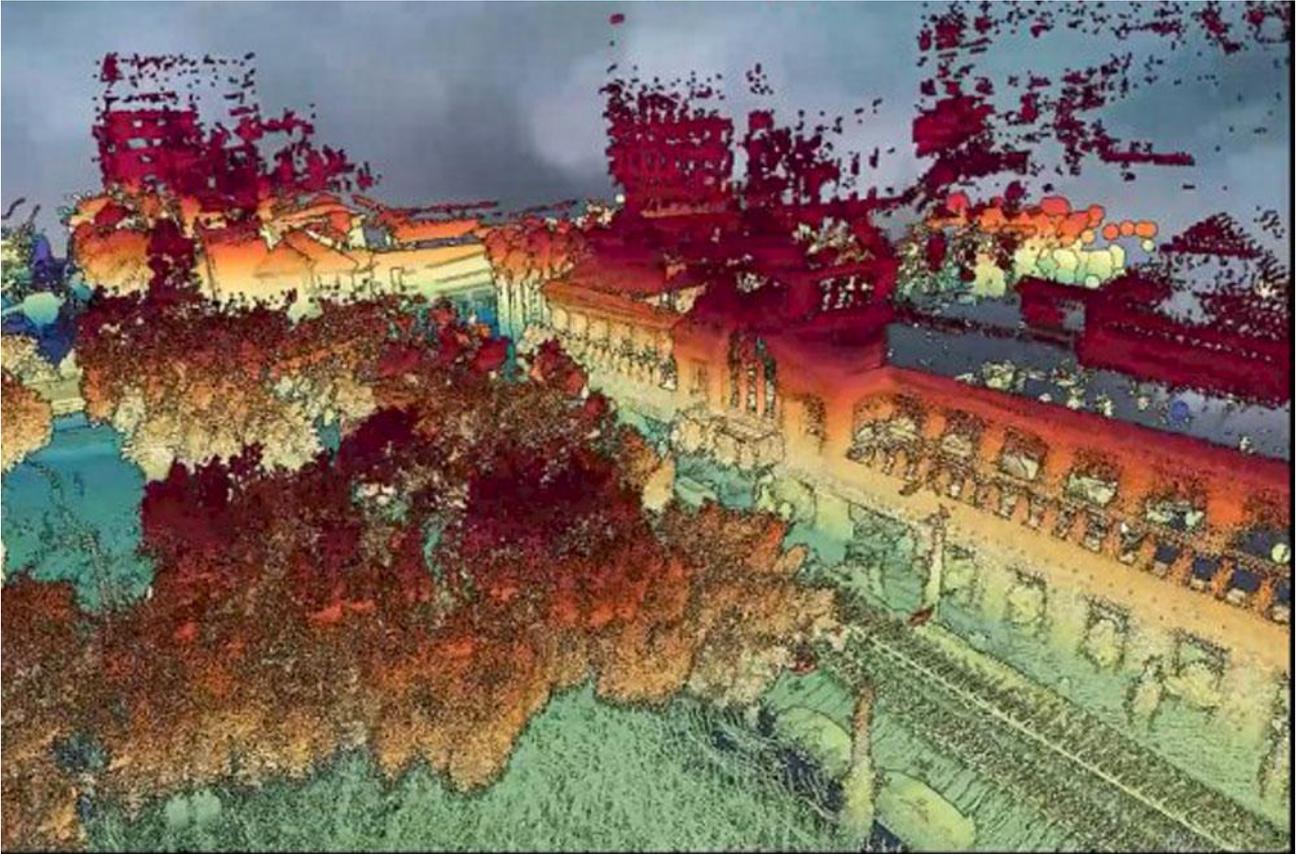
Velodyne Lidar have announced Kaarta Cloud® exclusively supports Velodyne's lidar sensors. Kaarta's new cloud-based application is a platform to process, store, and share 3D spaces. Paired with high-quality lidar to capture the environment in 3D, the data is uploaded into Kaarta Cloud to quickly and easily process it into a point cloud for use. High quality 3D mobile mapping is now available to a broader consumer base.

Three Velodyne sensors are supported by Kaarta Cloud. After using a Velodyne sensor to scan the environment, Kaarta uses **s**imultaneous **l**ocalization **a**nd **m**apping (SLAM) algorithms to instantaneously process lidar data into a registered point cloud map. This enables users to produce accurate, measurable 3D models and vivid visual representations of complex environments, whether they be buildings and infrastructure or dangerous and hard-to-reach areas.

"Kaarta Cloud is an exciting innovation for the growing ecosystem of software tools that allow Velodyne's lidar customers and partners to produce awesome 3D digital twins", says Velodyne's VP of Business Development Jon Barad. "Online SLAM processing of lidar data expands the capabilities, scope, ease of use and speed at which the user community can leverage Velodyne's sensors. This will help unlock the tremendous potential for lidar-based innovation and mapping applications". Velodyne Ultra Puck, Puck, and HDL-32E sensors deliver a high-resolution image to measure and analyse a variety of environments. They provide high-quality resolution and performance along with a full 360-degree environmental view to deliver real-time 3D data

General News

Volvo is Tops in Advanced Tech: Survey

Volvo ranks № 1 overall as well as № 1 for luxury brands in the J.D. Power Tech Experience Index Study. Tesla comes in second—an unofficial result due to a limited sample size. And Hyundai is the top mass-market brand. "Volvo is doing really well, with a high number of advanced technologies", says J.D. Power Executive Director of Driver Interaction and Human Machine Interface Research.

In keeping with their long-cultivated safety-oriented image, Volvo pack a lot of high-tech safety features into their cars and crossovers. For example, Volvo made automatic braking a standard component of their cross-traffic alert feature for the 2020 model year, on all vehicles equipped with blind-spot monitoring and cross-traffic alert, according to Volvo's media page.

The new version of JDP's so-called "TXI" Study assigns an "innovation ranking" to each brand, based on several criteria. New additions to the survey include camera rear-view mirrors that replace a mirror image with a video feed from a high-mounted, rear-facing camera. The camera provides a wider, less obstructed view. The 2020 TXI survey also newly includes questions on cross-traffic monitoring systems.

Volvo's winning rank was a score of 617 out of a possible 1,000; the industry average was 522. BMW was the official № 2, at 583 (Tesla's unofficial score was 593). After Hyundai at 556, Subaru is the № 2 mass-market brand at 541.

The 2020 U.S. Tech Experience Index Study is based on responses from 82,527 owners of new 2020 model-year vehicles who were surveyed after 90 days of ownership.

Beijing Auto Show Confirmed

The Beijing auto show is set to begin in late September in the Chinese capital. The country's biggest auto show will run from 26 September through 5 October, with media previews on 26-27 September.

Organisers of the show say a variety of measures will be implemented to ensure the safety of show participants and visitors, though it's unclear if capacity at the indoor event will be limited.
Following containment of the nationwide outbreak, sporadic cluster infections have emerged in several Chinese cities over the past few months.

To control virus transmission, the Beijing municipal government ramped up testing capacity and locked down residential areas near the market. On 6 August, the city government declared that all patients infected amid the local outbreak were cured and released from hospitals.

Crash Simulations Pave Toyota's Path to Safety

How much safer are AVs? When Toyota set about finding out, they made some interesting discoveries. Even when every vehicle was given every available ADAS technology, Toyota calculated a 54% drop in fatalities, which suggests realising "Vision Zero" initiatives will be harder and take longer than hoped. Rini Sherony, a senior principal engineer for Toyota's Collaborative Safety Research Center in Ann Arbor, Michigan, spoke at the virtual CAR Management Briefing Seminars. According to NHTSA, traffic fatalities in the U.S. dropped from a recent high of about 44,000 in 2005 to 33,000 in 2010 and 2011, then numbers rebounded to 39,000 in 2018.
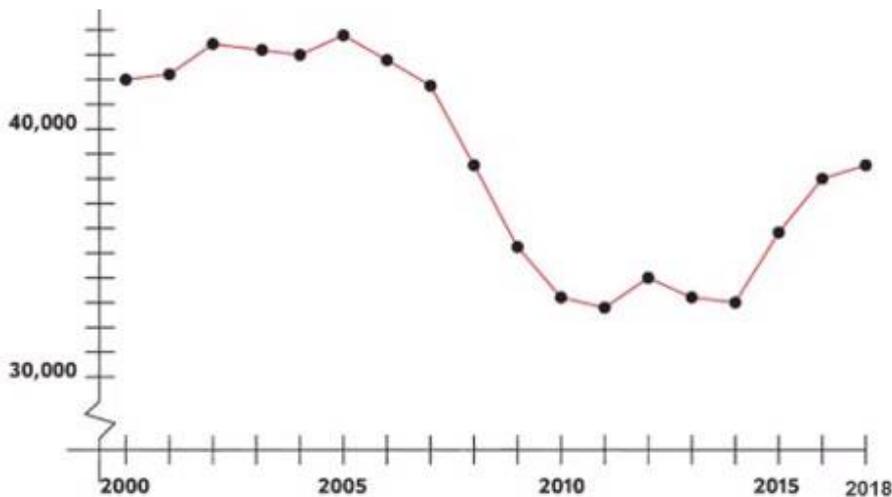
U.S> TRAFIC FATALITIES (IIHS)

Toyota partnered with Virginia Tech to analyse official crash databases and turn the statistics into thousands of simulated crashes. Simulations gave the company insight into which technologies would be the most effective to increase pedestrian and vehicle occupant safety. Toyota also analysed the kinds of vehicles involved in crashes as well as the types of crashes that kill people.
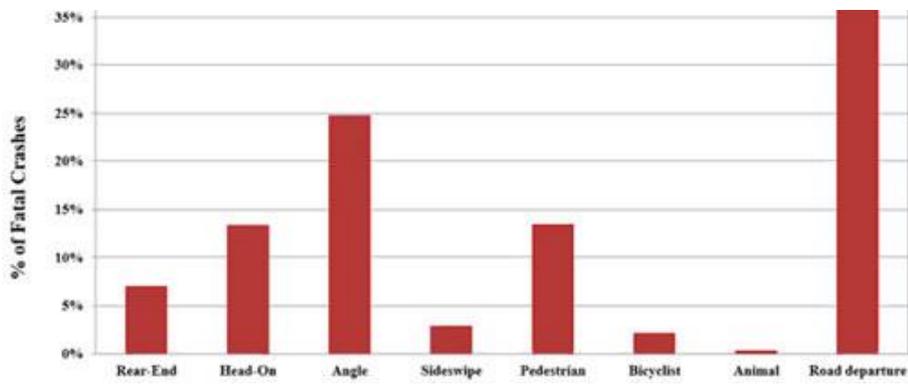
CRASH MODES

It turns out that offset crashes kill more people than head-ons, but the most dangerous type of crash is road departures, which makes up over 35% of all fatal crashes. Toyota needs this kind of data to understand and develop countermeasures, Sherony says.
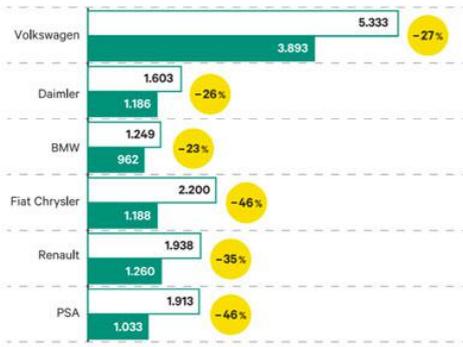
Using almost 2 million crashes from 2015 as the baseline, Toyota's research reveals the most effective technology to reduce crashes would be 100% implementation of rear-end automatic emergency braking (AEB) systems, which could prevent over 350,000 crashes a year in 2050.
The second-most effective technology is animal AEB (198,000), followed by Straight Crossing Path Intersection-ADAS (87,000).

How the Pandemic is Affecting Automakers

Europeans and Americans have limited the damage linked to the Covid-19.
Fears of a wave of failures with the total shutdown of their activity mostly didn't materialise, as companies managed to limit the damage. Nevertheless, the pandemic has made some big dents. The graphic shown here presents vehicle sales (×1,000) in H1-20 versus H1-19:

	H1-19	H1-20	Change
Volkswagen	5.333	3.893	−27%
Daimler	1.603	1.186	−26%
BMW	1.249	962	−23%
Fiat Chrysler	2.200	1.188	−46%
Renault	1.938	1.260	−35%
PSA	1.913	1.033	−46%

The big six European makers, deprived of €90bn worth of revenue in the first half of the year, were supported by their states—in particular through unemployment measures. The second semester still remains very uncertain; we'll have to watch and see what will happen.