

PRESS KIT



## 50 YEARS OF RESEARCH TO IMPROVE SAFETY FOR ROAD USERS



**GROUPE RENAULT**

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# WELCOME TO THE LAB!



## FOREWORD



*“Unique in Europe, the LAB is an EIG (economic interest grouping) made up of safety experts from Groupe PSA and Groupe Renault, formed to ensure safety for all.*

*Its strength lies in the varied and complementary skills of the people it mobilizes to improve safety, from engineers and data scientists to biomechanics experts, doctors and specialists in cognitive ergonomics.*

*The LAB is now celebrating 50 years of expertise based on observation, analysis and anticipation. Drawing on real accident data, the LAB can detect and interpret the results of its naturalistic studies to identify the various categories of risky behavior. It contributes this knowledge to European studies, sharing its observations and analyses so that all stakeholders in the field of safety can factor them into their action plans.*

*For example, the LAB has provided 78 scenarios of life-critical situations to be taken into account for validating the safety of highly automated vehicles.*

*The LAB can contribute its expertise at each stage of an accident: not only before, but also during and after. It is also constantly tackling the challenge of new technologies and new mobility patterns.*

*The LAB’s greatest strength is that it is part of both the present and the future, anticipating all possible avenues of progress, with the aim of constantly improving road safety for all users and all forms of mobility.”*

**Stéphane Buffat, Director of the LAB – Laboratory of Accident Analysis, Biomechanics and Human Behavior**

## THE LAB: MEETING THE NEEDS OF AUTOMAKERS SINCE 1969



*“The LAB’s work is a real asset for us as automakers. Its data and analysis are essential in defining new technologies for ever more safety on the roads.”*

**Carla Gohin, Vice President, Research, Innovation & Advanced Engineering, Groupe PSA**



*“Road safety is a major issue. And we have the good fortune of benefiting from the LAB’s expertise as a unique global benchmark.”*

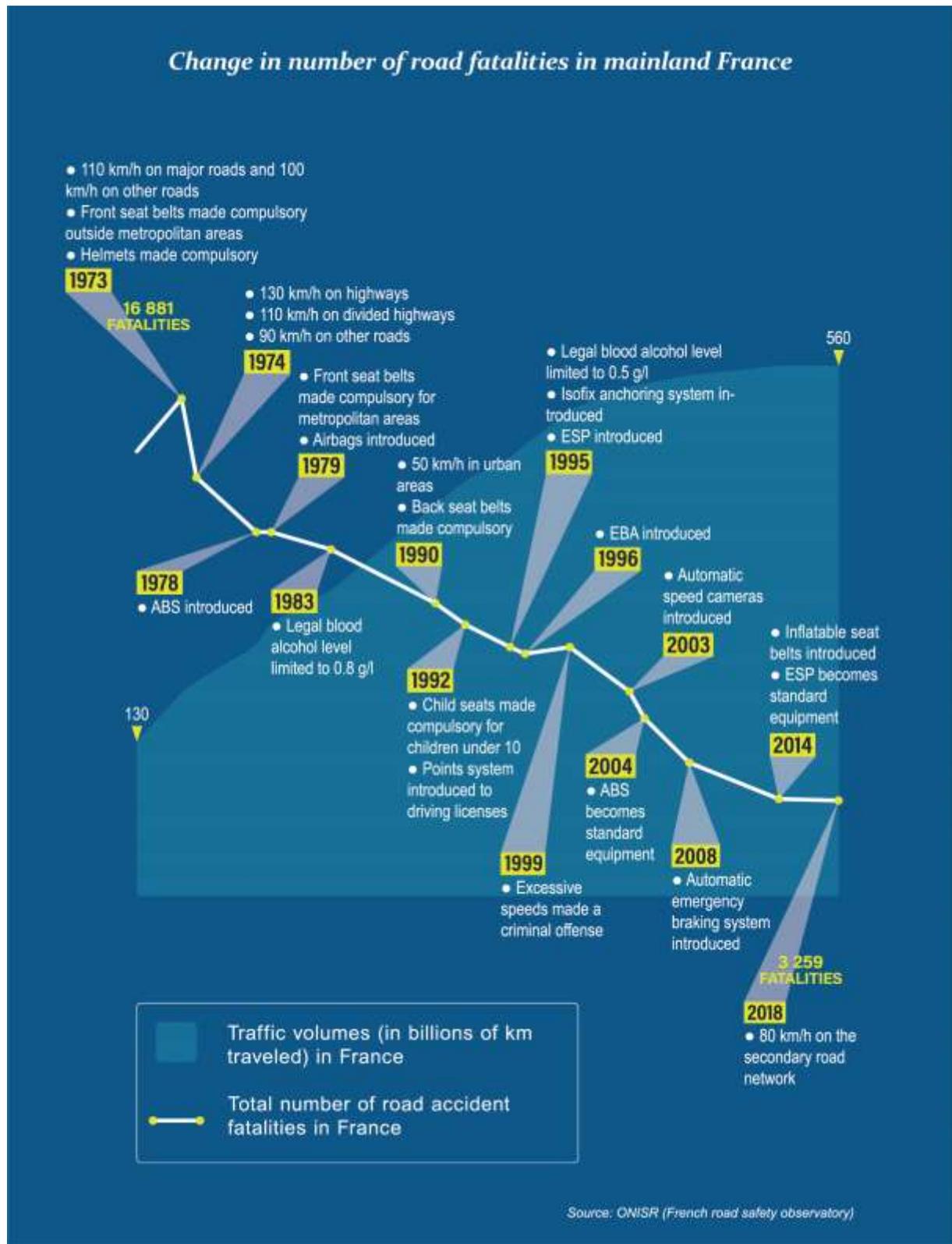
**Sophie Schmidlin, Alliance Global Director for Advanced Engineering, Groupe Renault**

## 50 YEARS OF RESEARCH TO IMPROVE ROAD SAFETY

Since 1969, Groupe PSA and Groupe Renault have been advancing road safety through the LAB, their Laboratory of Accident Analysis, Biomechanics and Human Behavior. Founded by Claude Tarrière in 1969, **it was the first example of two large carmakers joining forces in a non-competitive field in Europe.** The LAB is a major contributor to the scientific literature in its field.

Behind major advances in terms of road safety – knowledge of the behavior and tolerance levels of humans in all their diversity (age, height, sex, position, etc.) – the LAB helps market participants design forward-looking technologies to secure road user safety.

The decline in fatal accidents is chiefly attributable to technical progress in cars. Road fatalities peaked at 16,881 in 1973 in France. But the number has been reduced by 80% in the space



## The LAB's work

In response to demand from automakers or partners, the LAB studies advances in industrial research in three fields:

- **Accident analysis.**
- **Biomechanics.**
- **Human behavior.**

### **Accident analysis: studying the causes of accidents**

- Establishing a road safety and automotive safety diagnosis.
- Assessing the real effectiveness of safety systems.
- Estimating the potential gain for victims depending on the types of impacts and the prospective protection systems.
- Developing evaluation methodologies and digital simulation models.
- Issuing recommendations and proposals to carmakers.

### **Biomechanics: analysis of injury mechanisms**

- Developing tools (models, dummies, etc.) and knowledge (criteria, injury risk curves, injury mechanisms, etc.).
- Anticipating developments in engineering and regulation in three areas, namely crash test dummies, biomechanical criteria and virtual testing.
- Contributing scientific knowledge enabling lawmakers to develop regulations that better protect users.

### **Driver behavior: analysis of driving strategies and driver needs**

- Naturalistic studies: driving in natural conditions.
- Field operational tests: systems testing on the open road.
- On-track/simulator tests: controlled experimental conditions.

In this way, the LAB meets three objectives:

- Obtain knowledge of actual road hazards: observing behaviors, accidents and injuries.
- Adapt counter measures: understanding circumstances, failures and mechanisms.
- Innovate for future mobility: anticipating new uses, new challenges and new risks.

The LAB works simultaneously on regulatory, standardization and consumerist issues, which it addresses by releasing publications and developing training. It plays a role in a wide range of bodies with a view to sharing its scientific expertise:

- Pre-regulatory
  - Autonomous Vehicles Signaling Requirements
  - Regulatory
  - ECE NR 129 standard: approval of child seats
- Standardization
  - ISO (International Organization for Standardization)
  - TC 22 (Technical Committee): ergonomics, safety and impact testing
  - ADAG (Autonomous Driving Advisory Group)
- Academic research
  - Review and conference organization committees
  - Leader of collaborative projects and work packages
- Automaker associations
  - PFA (CSTA 14)
  - ACEA, EUCAR, OICA

Whether the goal is to analyze and understand the effectiveness of today's driver assistance systems (such as blind spot detection, lane departure warnings, etc.) or anticipate those of tomorrow, the LAB provides genuine expertise on all the methods that contribute to improving safety. Firmly anchored in the present, the LAB is also at home in the future, studying new uses and the potential accidents of tomorrow. Analysis and observation allow the LAB to make recommendations for future prevention systems in line with new mobility patterns.

Its expertise in accident analysis and human behavior makes the LAB a key player in the transition from driver assistance systems to automated delegated driving.

## **Achievements in the LAB's 50 years**

- Continuous collaboration between the two French automakers, PSA and Renault
- 642 scientific papers
- 30 theses
- 8 international awards
- 29 French or European collaborative projects
- 14 working groups

The LAB has a team of roughly twenty researchers, whose role is to evaluate the challenges and gains in terms of safety and to model the behavior of all road users. And their job does not stop there, since the LAB is also responsible for validating both prototype safety solutions and road user protection evaluation tools.

## **The LAB, an integrated and responsible scientific agent**

The LAB's employees are trained and overseen by a physician. They are also all graduates in ethics, which guarantees the reliability of their analysis methodologies, which are science-based, rigorous and transparent.

The varied and complementary talents of the LAB's experts ensure that its activities are recognized and respected by both the scientific road safety community and standardization bodies such as the French bureau of automotive standardization (BNA), not to mention consumer rating bodies like the Euro-NCAP (New Car Assessment Program).

The LAB draws on a very wide variety of jobs and skills, including engineers in biomechanics and automotive technology, specialists in cognitive and physical ergonomics, doctors, data scientists, statisticians and sociologists.

The LAB is committed to protecting personal data through compliance with the applicable laws (GDPR, General Data Protection Regulation) in terms of access, storage and ownership. Sensitive data are stored and processed by a trusted third party (CEESAR, European Center for Safety Studies and Risk Analysis) providing all the necessary guarantees.

Pursuing its overriding aim of serving the general public, the LAB issues publications to share the full range of its work with the entire scientific community. At the same time, it regularly organizes technical and steering committee meetings to share project follow-up and progress with its regular contacts.



## KEY DATES IN THE LAB'S HISTORY

- 1969** Creation of the Laboratory of Physiology and Biomechanics (LPB) in La Garenne-Colombes (northwest Paris suburb), with Claude Tarrière at its head.
- 1970** Creation of the accident database (to understand accident sequences).
- 1970** Publication of a study on the impact of the mandatory use of seatbelts in France.
- 1973** Start of work in biomechanics, including the use of dummies, and accident reconstruction.
- 1978** First international distinction: the LPB receives the Ralph H. Isbrandt Automotive Safety Engineering Award.
- 1980** Publication of the first study on fatal accident reports by the LPB.
- 1982** Development of the second-generation APROD (Association Peugeot Renault Omnidirectional Dummy).
- 1983** First LPB test campaign with child seats.
- 1984** Appearance of the first digital PRAKIMOD (Peugeot Renault Accident Kinematics MODel).
- 1986** Relocation to Nanterre (northwest Paris suburb)
- 1990** Work on primary accident analysis, publication of the second study on fatal accident reports: 18% reduction in the number of road fatalities in 10 years.
- 1991** Change of name from LPB to LAB, Laboratory of Accident Analysis and Biomechanics, headed by Jean-Yves le Coz.
- 1992** VSR (Vehicle and Road Safety) program partnership with INRETS to fine-tune the collection of accident data, simulator experiments to replicate accident conditions and development of the LABMAN dummy that replicates human kinematics in association with ENSAM (Arts et Métiers ParisTech engineering school).
- 1996** Implementation of a joint European database as part of the European Accident Causation Survey (EACS).
- 1997** Coordination by the LAB of three European child safety projects, CREST, CHILD and CASPER.
- 1999** Change of name: the LAB becomes the Laboratory of Accident Analysis, Biomechanics and Human Behavior, and develops experiments on avoidance strategies.
- 2000** Publication of the results of the study on the emergency brake assist system → 15% reduction in fatal accidents.

**2001** The LAB tackles driver behavior issues by creating “experimental psychology” and “sociological” teams. It conducts on-track testing on the loss of control in turns. It contributes to the European Council for Automotive R&D (EUCAR) working group on the development of electronic stability control (ESC), which reduces fatal accidents by 20%.

**2003** Publication of the third study on fatal accident reports. In the space of 30 years, the number of road fatalities in France has decreased by 63%. Experimentation of lane departure control systems.

**2004** Hervé Guillemot appointed director of the LAB.

**2005** Launch of a program to evaluate misuse of child restraint systems (with INRETS).

**2006** Completion of the European HUMOS2 program (injury risk prediction on the thorax and lower limbs), piloting of the European TRACE project to estimate the expected benefits of a selection of technological systems, launch of a naturalistic study on the open road (on 126 people) to improve understanding of the use of driver assistance systems.

**2007** Participation in the Global Human Body Models Consortium (GHBMC) project, which brings together automakers and equipment suppliers to create a series of “standard” human models of all sizes, with numerous control points (injuries to bones, soft tissues, etc.).

**2008** Anne Guillaume appointed director of the LAB.

**2009** Launch of the THORAX project to develop a new dummy thorax for frontal impact, pilot projects on pedestrian accident analysis with the French road safety foundation (FSR) and CACIAUP project to improve knowledge about accidents involving a motorist and a pedestrian.

**2010** Involvement in the DACOTA (road safety data, collection, transfer and analysis) project, which aims to develop accident data collection and exploitation systems to establish a European Road Safety Observatory.

**2012** Creation of the VOIESUR database in partnership with CEESAR, CEREMA and IFFSTAR.

**2012** Participation in the first large-scale study on driving in real conditions, the European UDRIVE project.

**2014** SCOOP@F study on connected vehicles, and continuation of the INDID project.

**2015** European SAFETY CUBE project aimed at developing an innovative decision support system in terms of road safety policy.

**2018** Far-side project, to propose an amendment to the Euro-NCAP protocol.

**2018** Stéphane Buffat appointed director of the LAB.

## AUTOMOTIVE TECHNOLOGY IN SUPPORT OF ROAD SAFETY

Speed cameras and lower speed limits are not the only reasons for the dramatic reduction in road fatalities recorded in France since 1973.

Technical progress by automakers has played a major role in the drop in deaths, thanks to the introduction of particularly effective new technologies.

Today,

- The risk of being killed by car has been reduced fivefold.
- The risk of serious to fatal injuries has fallen by 41% for drivers and 15% for front-seat passengers.
- Accident severity can be 30% lower in a vehicle made in 2018 than in a vehicle designed 20 years ago.

### Passive safety: reducing accident severity

In 1973, **seatbelts** became mandatory for people in the front seats, and were made compulsory for passengers in the back seats in 1990. They have been improved over the years with belt-locking systems and pretensioners, whose main function was to limit the movement of belted passengers at the beginning of deceleration.

Lastly, to reduce possible injuries caused by the belt itself load limiters were developed to reduce the stress exerted on the chest in the event of a collision. Its action is then completed by the air bag which distributes better the efforts on the whole of the rib cage.

- *Effectiveness of pretensioners: 47% reduction of injuries to the abdomen*
- *Effectiveness of load limiters: 41% reduction in thoracic injuries*
- *In 2017, 21% of people injured or killed were not wearing their seatbelt*

In 1979, the **airbag** made its appearance in Europe. Initially reserved for the driver, it was subsequently extended to passengers. New cars sold in Europe today have between two and nine airbags, depending on the car's level of quality.

- *Frontal airbag effectiveness: 60% reduction of moderate injuries (and an end to facial fractures) and 80%-90% reduction in serious to fatal head injuries.*

## **Active safety: avoiding or mitigating the impact of an accident**

In recent years, automakers have focused their efforts on the partial or total avoidance of accidents through the development of increasingly sophisticated driver assistance systems.

### **First wave, starting in 1978**

In 1978, Anti-lock Braking Systems (**ABS**) were first fitted on high-end cars, before being extended to other classes of vehicle and becoming mandatory from 2004.

In 1995, Electronic Stability Control (**ESC**) systems made their appearance, becoming mandatory in November 2014.

In 1996, Emergency Brake Assist (**EBA**) shortened braking distances, helping prevent accidents or reduce their severity.

- *In France, 18% of bodily accidents result from loss of control of the vehicle.*
- *According to recent studies, the mandatory fitting of ESC + EBA systems would reduce the number of people killed or seriously injured by 70%.*

### **Second wave, currently being rolled out on all Groupe PSA and Groupe Renault vehicles**

**Emergency Braking Systems (AEBS)** can automatically apply the brakes when their sensors detect an obstacle. They are currently being rolled out on all Groupe PSA and Groupe Renault vehicles.

- *The LAB's results show that if all vehicles on the road in France were fitted with AEBS, the number of roads deaths and serious injuries would fall by 10% and 15% respectively.*

**Adaptive Cruise Control (ACC)** helps the driver keep a safe distance from the vehicle ahead and automatically adjusts the vehicle's speed to the traffic.

**Lane Keeping Alert and Lane Keeping Assist (LKA)** warns the driver and corrects the path if the vehicle is about to cross the line without indicating, one of the major causes of highway accidents.

**Driver attention alert by camera** Detects driver drowsiness and inattention.

Plus other automated functions under development to improve safety for all.

## ACCIDENT TIMELINE

Here is an illustration of an accident sequence. Each moment corresponds to a time scale. Driver assistance systems will react instantaneously, whereas means of restraint, such as seatbelts, will act on the scale of one-tenth of a second. After the accident, help will be needed as soon as possible, ideally within an hour.



The six workshops organized for the LAB's 50<sup>th</sup> anniversary are split into three chronological workshops and three thematic workshops.

- **Before the accident**

*“Our role is to anticipate accidents and understand the behavior of drivers in real accidents. We carry out naturalistic studies that allow us to construct typologies of risk situations. ‘Cutting in’, more commonly known as fishtailing, is one of them.”*

Laurette Guyonvarch, Driver Behavior Activity Manager  
Erwan Lecuyer, Data Scientist

- **During the accident**

*“We collect accident data in the field to add to our unique database in France. Head-on impacts are the most common. Our goal is to reduce the consequences of accidents by understanding injury mechanisms.”*

Maxime Labrousse, Secondary Accident Analysis Liaison  
Stéphane Mogodin, Accident Analyst

- **After the accident**

*“We evaluate the effectiveness of warning systems like eCall by analyzing accidents. Advanced eCall will be a major asset in adapting, adjusting and better qualifying needs in terms of treatment and assistance, in coordination with emergency platforms.”*

Cyril Chauvel, Deputy Director – Accident Analysis Expert – Accident Analysis Activity Manager  
Franck Leopold, Accident Analyst

- **Biomechanics, new uses of mobility**

*“Changes in the population (in terms of weight, age, etc.) must be taken into account in the development of new vehicles, which means offering more appropriate tools such as modeling. Accordingly, the LAB provides automakers with comprehensive information on trends in morphology and the use of mobility, helping better take into account this diversity in the development of means of protection.”*

Philippe Petit, Biomechanics Activity Manager

Xavier Trosseille, Biomechanics Expert

- **Connectivity in support of mobility**

*“The LAB studies the challenges and the gains that connectivity can bring to road safety. Through the SCOOP@F project, we have developed a unique method of collecting data in real conditions from 50 users and ten automotive experts over six months.”*

Laura Bigi, Accident Analysis Synthesis Manager

Arnaud Koustanai, Driver Behavior Psychologist

- **Accident simulations**

*“We reconstruct digital crash scenarios to evaluate the effectiveness of Advanced Driver Assistance Systems (ADAS), such as the AEB Automatic Emergency Braking system. The accident reconstruction activity is the only one of its kind in France. Fifty accidents have been recreated virtually every year since the mid-1990s.”*

Henri Chajmowicz, Accident Analyst

Philippe Lesire, Accident Analyst

## Annex: LAB publications in 2018-2019

### Accident analysis: studying the causes of accidents

- Comparison of expected benefits of vehicle primary safety on road casualties (*N. Bertholon of the LAB, S. Cuny & V. Phan of CEESAR*) *Hanover ESAR 2018*.
- A Tool to Assess Pedestrian Safety: Risk Curves by Injury Severity and Their Confidence Intervals for Car to Pedestrian Front Collision (*S. Cuny of CEESAR, H. Chajmowicz, K. Yong, N. Bertholon & E. Lécuyer of the LAB, T. Hermitte of Groupe Renault*) *Athens IRCOBI 2018*.
- Improving Cyclist Safety: Challenges in Designing Effective Autonomous Emergency Braking Systems for Passenger Cars (*H. Chajmowicz of the LAB*), *S. Cuny & J. Saadé of CEESAR, T. Hermitte of Groupe Renault*) *Barcelona ICSC 2018*.
- SCOOP@F Seminar; Impacts non technique des système CITS : enjeux et méthodologie d'évaluation d'efficacité/ bénéfique (*C. Chauvel & L. Guyonvarc'h*) *2018*.
- 16<sup>th</sup> International Conference, Protection of Children in Cars, Sociocultural Aspects in Road Traffic Safety (*P. Lesire of the LAB, M. Paff of Childhood Business, K. Arbogast of CHoP*) *2018*.

### Biomechanics: analysis of the injury process

- Far Side Simulations Using the GHBMCM50-O and WorldSID M50 Models (*P. Petit, X. Trosseille, E. Lécuyer, D. Poulard, P. Baudrit*), *Human Modeling and Simulation in Automotive Engineering 2018 – 7<sup>th</sup> International Symposium Munich, Germany, October 18-19 (2018)*.
- Updated Chest Injury Criterion for the THOR Dummy (*X. Trosseille, P. Baudrit 2019*) *25<sup>th</sup> ESV Conference, Eindhoven, NL, June 2019. Paper 19-0236*.
- Transformation Smoothing to Use after Positioning of Finite Element Human Body Models (*T. Janak, Y. Lafon, P. Petit, P. Beillas*) *IRCOBI Europe Athens, Greece, September 12-14 (2018/Europe)*.
- A Method to Use Kriging with Large Sets of Control Points to Morph Finite Element Models of the Human Body (*Tomas Janak, Yoann Lafon, Philippe Petit, Philippe Beillas*) *Journal of Medical Engineering and Physics (2019)*.

### Driver behavior: analysis of driving strategies and driver needs

- Automatic Annotation of Secondary Task While Driving: Achievement with UDRIVE Data and Next Challenges (*L. Guyonvarc'h*) *TRB Conference Washington DC 2018*.
- Driving Style Indicator Using UDRIVE NDS Data (*L. Guyonvarc'h, F. Duvivier, C. Val & A. Guillaume, T. Hermitte*) *Traffic Injury Prevention 2018*.
- Is the Self-confrontation Method Applicable to Naturalistic Driving Studies? (*C. Barbier, L. Guyonvarc'h, A. Guillaume, H. Tattegrain*) *Safety Science 2018*.
- Mise en œuvre d'un journal de bord intelligent pour l'évaluation d'un ITS dans le projet SCOOP (*A. Koustanai, C. Val, C. Barbier, L. Guyonvarc'h*) *2018*.
- Naturalistic Data for ADAS Validation (*E. Lécuyer, L. Juste, L. Guyonvarc'h*) *SIA Digital Simulation Conference 2018*.
- Studying ITS Acceptability: the SCOOP Experience (*L. Guyonvarc'h, A. Koustanai, C. Barbier*) *ITS Europe Conference, The Netherlands 2019*.

## Media contacts

### **About Groupe Renault**

*Groupe Renault has manufactured cars since 1898. Today it is an international multi-brand group, selling close to 3.9 million vehicles in 134 countries in 2018, with 36 manufacturing sites, 12,700 points of sales and employing more than 180,000 people. To address the major technological challenges of the future, while continuing to pursue its profitable growth strategy, Groupe Renault is focusing on international expansion. To this end, it is drawing on the synergies of its five brands (Renault, Dacia, Renault Samsung Motors, Alpine and LADA), electric vehicles, and its unique alliance with Nissan and Mitsubishi Motors. With a 100% Renault owned team committed to the Formula 1 World Championship since 2016, the brand is involved in motorsports, a real vector for innovation and awareness.*

More information on [group.renault.com](http://group.renault.com)

Media site: [www.media.renault.com/](http://www.media.renault.com/)  @Groupe\_Renault

Media contact: Orianne Tamburini/+33 (0)6 26 63 28 14/[orianne.tamburini@renault.com](mailto:orianne.tamburini@renault.com)

### **About Groupe PSA**

*Groupe PSA designs unique automotive experiences and delivers mobility solutions to meet all customer expectations. The Group has five car brands, Peugeot, Citroën, DS, Opel and Vauxhall, as well as a wide array of mobility and smart services under its Free2Move brand, aiming to become a great car maker and the preferred mobility provider. An early innovator in the field of autonomous and connected cars, Groupe PSA is also involved in financing activities through Banque PSA Finance and in automotive equipment via Faurecia.*

Find out more at [groupe-psa.com/en](http://groupe-psa.com/en).

Media library: [medialibrary.groupe-psa.com/](http://medialibrary.groupe-psa.com/)  @GroupePSA\_EN

Media contact: Alain Le Gouguec/+33 (0)6 42 59 27 84/[alain.legouguec@mpsa.com](mailto:alain.legouguec@mpsa.com)