Cerema
CLIMAT & TERRITOIRES DE DEMAIN

RESEARCH TEAMS

IN THE MOBILITY SECTOR

©iStock

INSTITUT
CARNOT
Clim'adapt

Mobility, whether it concerns goods or people, is essential for contemporary societies. It allows residents to carry out their activities, businesses to operate and localities to live. However, it is responsible for a third of national greenhouse gas emissions and their reduction is today a goal that is as essential as it is difficult to achieve. **Technical, organisational and social innovations are therefore indispensable.**

©iStock

Cerema makes available its **expertise and research** to **local authorities, the State and businesses**, to develop the **innovations** that our country needs to achieve its objectives in terms of **cutting carbon** and **reducing its GHG emissions**.

Through the Institut Carnot Clim'adapt, it supports companies and local authorities at all stages in the development of their innovations, from the validation of concepts to the search for outlets, including experiments in a controlled environment or in a real situation with partner local authorities.
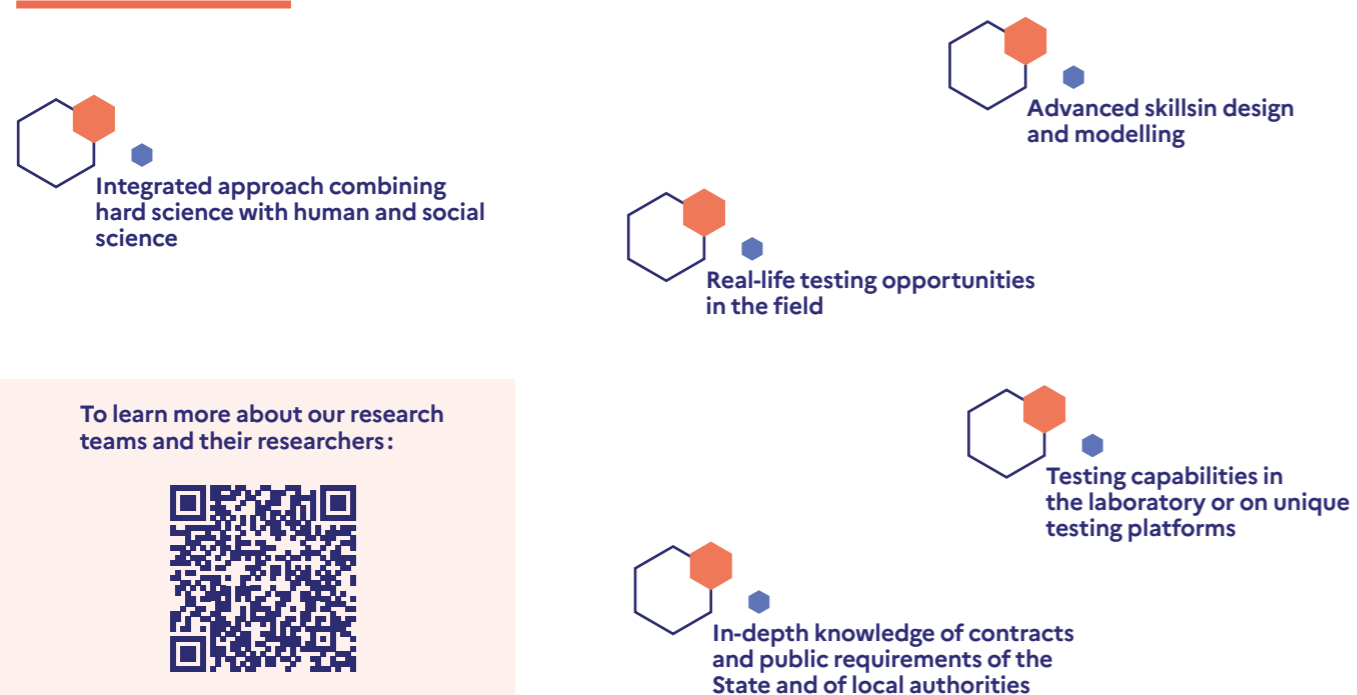
KEY INFORMATION

- **Institut Carnot** is endorsed by a benchmark **public Research and Expertise** establishment
- **4 high-level research teams** specialising in the field of **mobility**
- Laboratories, testing platforms and real-world testing opportunities in the localities

A SYNERGY OF ACTIVITIES

- Methodological research, modelling and expertise
- Support for state and local public policies
- Training of public and private professionals in the mobility field
- Production, capitalisation and dissemination of professional knowledge

WHAT RESEARCH TEAMS HAVE TO OFFER

Integrated approach combining hard science with human and social science

Real-life testing opportunities in the field

Advanced skillsin design and modelling

Testing capabilities in the laboratory or on unique testing platforms

In-depth knowledge of contracts and public requirements of the State and of local authorities

To learn more about our research teams and their researchers:

WHY CALL ON CEREMA'S MOBILITY RESEARCH TEAMS?

- **The combination of Technical expertise and knowledge of public policies** allows us to guide businesses in the development of their products by aligning them with the expectations of mobility policies.

- **New product development** to support businesses by helping them understand how these products can meet the needs of the market and fit into public mobility policies.

- **Laboratory or controlled testing.**

- **Assessment of existing technology** to help businesses identify the most suitable solutions for their needs and those of their partners.

- **Designing innovative solutions** to meet the challenges of urban and peri-urban mobility, working in close collaboration with businesses and local authorities to develop tailor-made solutions.

INSTITUT CARNOT CLIM'ADAPT

Institut Carnot Clim'adapt is developing partnership-based research, i.e. management of research work conducted by public sector laboratories in partnership with socio-economic players, businesses of all sizes and local authorities, in order to meet their needs.

For more information

By making use of Cerema's exceptional resources and regional coverage relating to research, engineering, expertise and equipment, Clim'adapt supports its partners to enable them to transition to a resource-efficient, carbon-free, environment-friendly economy, linked to new life styles engendered by digital transition and adaptation to climate change.

UMR MATRIS JOINT RESEARCH UNIT

MOBILITIES, PLANNING, TRANSPORT, RISKS AND SOCIETY

Since its creation in 2022, the MATRIS research team has focused on the dynamics of change in transport and development systems in order to better understand them and support the transition towards future mobility.

©Cyprien Richer - Cerema

38 MEMBERS

4 SCIENTIFIC AREAS

9 ONGOING PROJECTS

4 BRANCHES IN FRANCE

SUBJECTS OF EXCELLENCE

- **Mobility needs and expectations** (public passenger transport/active modes/ intermodality/ mobility of seniors / logistics including cyclo-logistics and short food chains)
- **Determinants of mobility trends** (passengers, freight)
- **Governance of mobility, transport and development services:** SERM (Services express régionaux métropolitains - Metropolitan Regional Express Services), MaaS (Mobility as a service), commercial ports, logistics areas
- **Evaluation of public policies** (structuring effects of transport infrastructure, impact of transport policies on the location and mobility of households, acceptability of road safety policies)
- **Design of multimodal exchange hubs**

VALUE PROPOSAL

- Objectivising the value of innovations, particularly in the mobility and logistics segments (e.g.: LOGICOUT)
- Audits, training in subjects of excellence

SKILLS

- Survey methods based on social psychology, sociology, real-life observations, participatory research
- Statistical analyses of qualitative or quantitative variables
- Modelling of the urban economy type, econometrics

FOCUS ON THE INSTITUT CARNOT CLIM'ADAPT & TRANSDEV OPERATOR PARTNERSHIP

The project with Transdev company aims to propose **a demand-responsive transport service via self-driving and connected vehicles** that guarantee **user safety**. In partnership with Cerema, it assesses the road safety issues related to the circulation of these vehicles on open roads as part of the *Rouen Normandy Autonomous Lab* experiment. The study includes observations, user surveys, and will lead to methodological recommendations for local authorities.
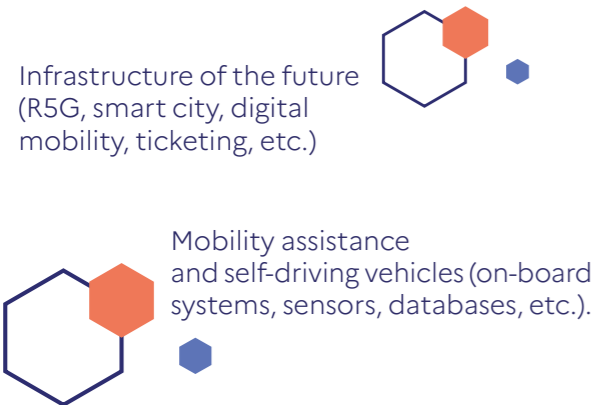
ITS - INTELLIGENT TRANSPORT SYSTEMS

The ITS team takes a systems-based approach by integrating the interaction between infrastructure, the vehicle and the driver. It addresses the issues of safety, operation, sustainable mobility and energy in relation to technological advances, such as roads of the future, the digital revolution, driver assistance systems, and self-driving vehicles.

Research is structured around two scientific areas, representing two study subjects:

Infrastructure of the future (R5G, smart city, digital mobility, ticketing, etc.)

Mobility assistance and self-driving vehicles (on-board systems, sensors, databases, etc.).

SUBJECTS OF EXCELLENCE

- **Modelling and simulation of weather and environmental conditions:**
  - Characterisation, modelling, simulation and reproduction of conditions etc.
  - Modelling and simulation of heat transfer and radiative transfer at any wavelength

- **Artificial perception and artificial vision for vehicles:**
  - Camera-based weather condition detection
  - Performance analysis of artificial perception sensors

- **Evaluation and analysis of mobility systems:**
  - Multi-criteria assessment of the impact of on-board or remote mobility assistance systems on road infrastructure
  - Processing of data generated by digital mobility: trajectory analysis, generation of origin / destination matrices, extraction of road risk indicators

VALUE PROPOSAL

- Fog and rain sensor validation test
- Spectral characterisation of optical properties of road surfaces
- Impact study of smart and sustainable mobility solutions: efficiency, environment, safety
- Urban overheating impact study

COMPÉTENCES

- Physical modelling
- Artificial intelligence (Machine Learning)
- Image and data processing and analysis

FOCUS ON THE INSTITUT CARNOT CLIM'ADAPT & LHOIST GROUP PARTNERSHIP.

Faced with the challenges posed by urban overheating, Lhoist has developed a **whitewash solution to increase road albedo**. Through its Institut Carnot Clim'adapt, Cerema has conducted a laboratory and on-site study to assess the impact of this solution to lower surface temperatures. **The results showed a possible control of the albedo according to the concentration of whitewash and a very significant impact on surface temperatures.**

The new PAVIN Extreme Weather platform from Cerema.

PSYCAP - APPLIED PSYCHOLOGY

The PsyCAP research team studies and furthers our understanding of individual behaviour in an effort to support change, whether caused by the digital revolution, or brought about by climate change.
In the «Mobility» field, it studies driving behaviour (vehicles) and travel behaviour (pedestrians, cyclists, etc.): what people do and why they do it, with the aim of evaluating road developments, Intelligent Transport Systems (ITS), Cooperative ITS (C-ITS), new sustainable mobility solutions or even automated vehicles.

© Lara Désiré - Cerema

PsyCAP uses knowledge from cognitive science (attention, mental load), movement science (perception, information acquisition, decision making, interaction) and social psychology (attitudes, representations, norms, etc.) to study the observable and self-reported behaviour of individuals. The research team has access to dedicated study platform including a driving simulator, an instrumented vehicle and a remote oculometer.

SUBJECTS OF EXCELLENCE

- **Assessment of road developments:** crossover studies of behaviours observable in the laboratory (simulator with oculometer) or in real life (embedded cameras and oculometer for the observation vehicle or cameras installed at the roadside) with self-reported behaviours (surveys, questionnaires on psycho-social determinants of behaviour).

- **Road safety and behaviour:** understanding and preventing hazardous behaviour on the road / developing strategies to improve the safety of road users.

- **Study of the acceptability of ITS, C-ITS or self-driving vehicles:** evaluation of driver assistance systems and their impact on driver behaviour / Factors influencing use or cohabitation with other users.

- **Sustainable mobility and climate change:** study of mobility behaviours in response to emission reduction policies/ adaptation of travel habits to fit in with sustainable mobility strategies.

VALUE PROPOSAL

Cerema is in touch with the field and can help to clearly see the feasibility of ideas before they are launched.

SKILLS

- **Analysing human behaviour:** understanding and predicting how people respond to innovation and environmental change
- **Transition support:** development of methodologies to facilitate technological and organisational transitions
- **Cognitive science and social psychology:** expertise in the study of observable and self-reported behaviours for a comprehensive approach to human behaviour
- **Support for innovation:** use of knowledge in psychology to support innovation.

STATEMENT BY STÉPHANIE BORDEL - Head of the PsyCAP research team

"It's not enough that a development, technological innovation or product be designed in line with the best current standards, or is endowed with optimal ergonomics and positively reviewed by most people for people to buy and use the product" (Bordel & Somat, 2015). A study by Andréani (2001) highlights that 95% of innovations put on the North American market are failures, even though the study by Jørgensen et al. (2014) points to the failure to take into account the human factor as the cause of these failures. The PsyCAP team is positioned in a co-construction logic of Science for the Engineer - Humanities and Social Sciences to support innovation and change in a climate change situation."

EL - LIGHTING AND LIGHT

Cerema's Lighting and Light (EL) research team focuses on optimising night-time lighting to reduce energy consumption, reduce light pollution and take into account the specific uses (by pedestrians, cyclists, motorists) of lit spaces. Its research explores visual perception, the propagation of light and the role of surfaces, the modelling of light pollution, and road visibility. The EL team also draws on specific expertise in light measurement and the development of innovative measurement methods and systems to conduct its research.

Structured around three main areas, its research program includes **modelling the human visual system (HVS), optimising road lighting installations and assessing the visibility of road objects.** The EL team also draws on two cross-cutting missions: **in light measurement and the development of innovative measurement methods and systems to conduct its research.**

© Olivier Pichard - Cerema

SUBJECTS OF EXCELLENCE

- Study of visibility conditions of road users and public spaces, especially under artificial night lighting
- Optimisation of road lighting installations to reduce energy consumption and reduce the impact of light on the environment
- Research on the visual perception of users and on the visibility of road and urban developments
- Participation in French (AFNOR X90X), European (CEN TC169 WG12) and global (CIE) standardisation work

VALUE PROPOSAL

- Multi-factor optimisation of road lighting installations
- Diagnosis of infrastructure visibility, innovative signalling devices, equipment and urban furniture
- Systemic approach in the design of developments (uses, visibility, visual comfort, energy footprint, albedo, etc.)

SKILLS

- Considering visual needs according to uses and examining the impact of conditions (lighting, weather, etc.) on visual performance
- Accompanying communities towards light saving
- Assessing alternative and/or innovative development solutions to optimise travel safety and reduce the mobility carbon footprint
- Development of innovative measurement methods and tools to evaluate photometric (illumination, luminance), colorimetric or optical properties of surfaces.

FOCUS ON THE INSTITUT CARNOT CLIM'ADAPT & COLAS COMPANY PARTNERSHIP

With its expertise in road safety and infrastructure assessment, Cerema is partnering with Colas to develop Flowell, an innovative light signalling solution. Thanks to its technical and scientific skills, Cerema supports experiments (Nantes, Mandelieu-la-Napoule, etc.), the definition of the evaluation prototypes and the analysis of results. More specifically, the EL team assesses the visibility of technology in all conditions (day, night, weather, type of media), the control of the luminous fluxes emitted and the limitation of visual nuisances such as glare. Its work has contributed to Flowell's certification for pedestrian crossings.

CONTACTS

UMR MATRIS TEAM
Ludovic Vaillant : ludovic.vaillant@cerema.fr
Romuald Lacoste : romuald.lacoste@cerema.fr

ITS TEAM
Louahdi Khoudour : louahdi.khoudour@cerema.fr
Guillaume Saint Pierre : guillaume.saintpierre@cerema.fr
Frédéric Bernardin : frederic.bernardin@cerema.fr

PSYCAP TEAM
Stéphanie Bordel : stephanie.bordel@cerema.fr
Lara Désiré : lara.desire@cerema.fr

EL TEAM
Florian Greffier : florian.greffier@cerema.fr
Vincent Boucher : vincent.boucher@cerema.fr

@cerema   @ceremaCom   www.cerema.fr

RÉPUBLIQUE
FRANÇAISE
Liberté
Égalité
Fraternité

Cerema
CLIMAT & TERRITOIRES DE DEMAIN