A CONTROLLED ENVIRONMENT FOR TESTING SENSORS UNDER ADVERSE WEATHER CONDITIONS : THE CEREMA R&D FOG AND RAIN PLATFORM

Michèle Colomb* , Pierre Duthon, Frédéric Bernardin, Cerema, Clermont-Ferrand, France
** Email : michele.colomb@cerema.fr*

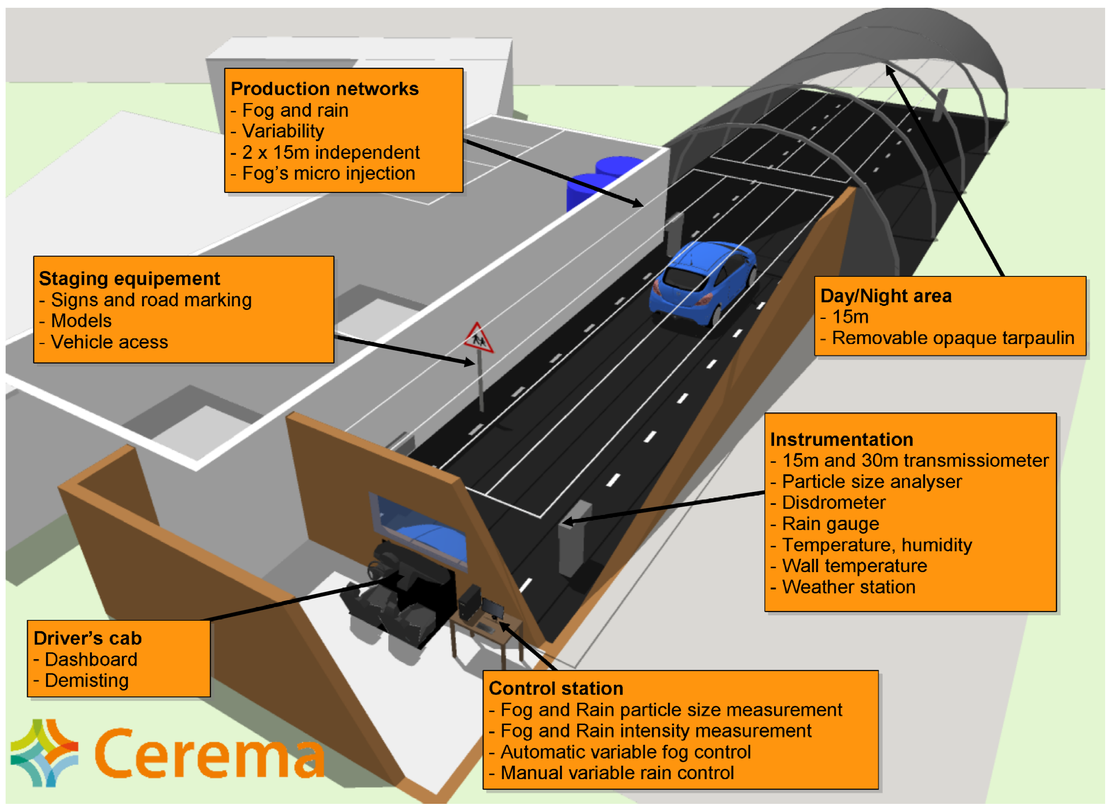
Centre for studies and expertise on risks, the environment, mobility and urban and country planning

Introduction

Perception ability of driver assistance sensors may be heavily reduced when submitted to adverse weather conditions, mostly fog and rain. Studies in reduced visibility conditions are difficult to carry out in on-road conditions for obvious safety reasons; but also for scientific matters: natural phenomena are quite random. This implies to carry out tests in a controlled environment, ensuring repeatability of disruptive weather events, in order to quantify the impact in terms of performance loss.

A research infrastructure has been built and developed by Cerema at Clermont-Ferrand. This platform makes it possible to reproduce and control fog's and rain's characteristics, namely particle size, meteorological visibility, and rain intensity.

The R&D Fog and Rain platform



Technical data

The track consists of 2 parts:
- a tunnel, of durable construction
- a greenhouse of lightweight construction, maintained by arches and covered by two sheets, one black and one transparent (for daytime conditions).

View of the platform track of the Clermont-Ferrand laboratory

Tunnel characteristics	
Length	15 metres
Width	5.5 metres
Roof clearance	2.6 metres
Greenhouse characteristics	
Length	16 metres
Width	8.5 metres
Clearance under arches	2.4 metres
Measuring equipment	**Physical parameters and measuring ranges**
Transmissiometers	Meteorological visibility from 5 to 1000 m
Video-photocolorimeter	Luminance from 0.003 to 50000 cd/m²
Optical granulometer	Particle size from 0.4 to 40 microns
Spectro-pluviometer	Rainfall intensity from 0.001 to 1200 mm/h

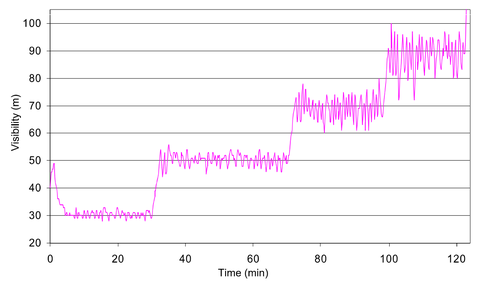
Applications of the platform

The platform is used for various Research and Innovation applications:

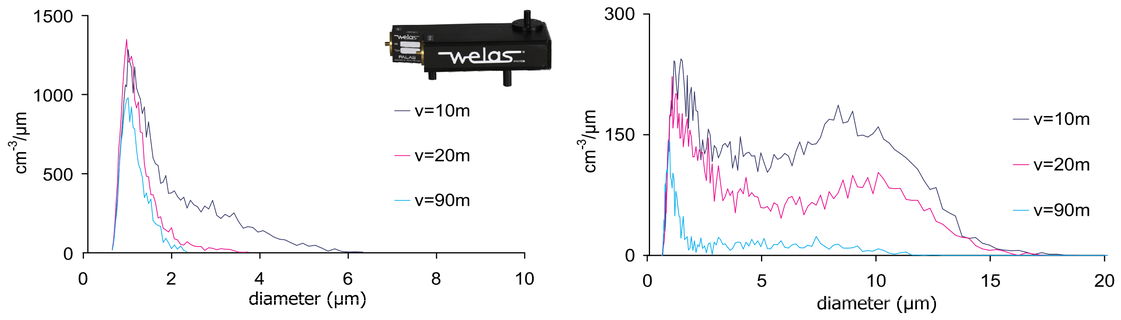
- methodological development to compare artificial and human vision systems
- development of algorithms for image analysis and processing in adverse weather conditions
- application and development of new imaging technologies in the specific conditions of fog (infrared, laser…)
- performance testing of upcoming advance driver assistance systems (ADAS) including automatic obstacle detection features (lidar, radar…)

Physical characteristics

Fog

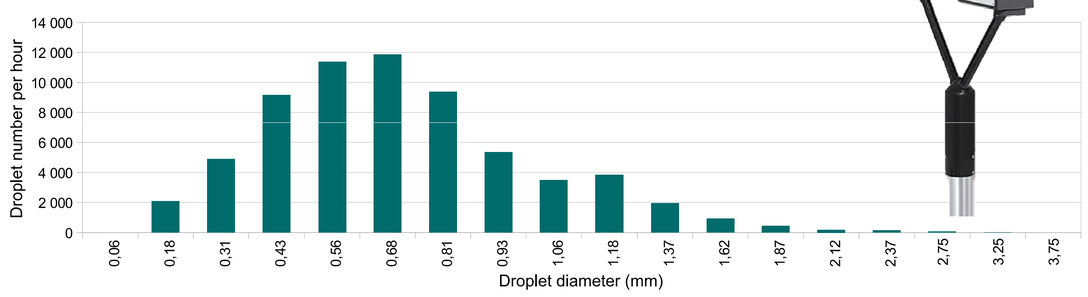


Fog production at various visibility levels



Exemple of artificial fog granulometry with various droplet sizes

Rain



Rain droplet size distribution

Conclusions

The Cerema Research & Development platform is the only place in Europe producing controlled adverse weather conditions. The development of testing methodologies with industrial partners may contribute to the establishment of EuroNcap or other testing standards. This infrastructure is already identified as testing platform of ViaMeca cluster, LabEx IMobS3 and the French project "Nouvelle France Industrielle Véhicule Autonome" dedicated to autonomous vehicles.

Testing in adverse weather condition is crucial for the developments of systems allowing to assess their own ability to take control of the vehicle referring to the 5 levels of car automation.

French and international academic partnerships

Universities: Clermont-Ferrand, Nancy, Lyon, Liège, Glasgow, Riga

French Ministry for Environment, Energy and Sea (MEEM), road directorate for the Massif Central (DIRMC)

Public and private research centres (French Institute of Science and Technology for Transport, Development and Networks - IFSTTAR, Météo-France, National Optics Institute, Canada - INO)

French and european industrial collaborations

Automotive and aeronautical equipment suppliers

Manufacturers specialized in
- road safety,
- traffic management,
- automatic obstacle detection,
- information and communication technologies (road networks video monitoring)