



Helping industry
and public services
to improve road safety

EUROPEAN CENTER FOR SAFETY STUDIES AND RISK ANALYSIS:

Non profit association, created in 1992 to **improve road safety**, with ethical guarantees controlled by a scientific council.

Members :

french car manufacturers, automotive suppliers, insurance companies, universities, engineering schools, medical and industrial world personalities

**« ACCIDENTOLOGY & CRASH AVOIDANCE,
DUMMIES & NUMERICAL CALCULATION »**

***« Accidentologie et évitement,
mannequins et calcul numérique »***



SUMMARY:

SOMMAIRE:

1. **France road safety** story, from passive to active safety, from huge improvement to recent increase of road fatalities.
2. **France accident database**, with car overlap as example of collected data for a frontal crash.
3. Recall of **frontal crash regulatory dummy** in Europe, including EuroNCAP demanding test.
4. **Bio-fidelity improvements** required from future dummy, to get higher representativity of human body.
5. One example of **active safety improvement**, ABS efficiency and worldwide generalisation.
6. **Accident typology modified by ABS** vehicle technology, increase of small overlap frontal crashes.
7. The **Human Body Model calculation**, much more versatile, now efficient and at the same time now necessary.
8. A key **contribution required for human behaviour**, Safe Eco Driving, which imply to work together.



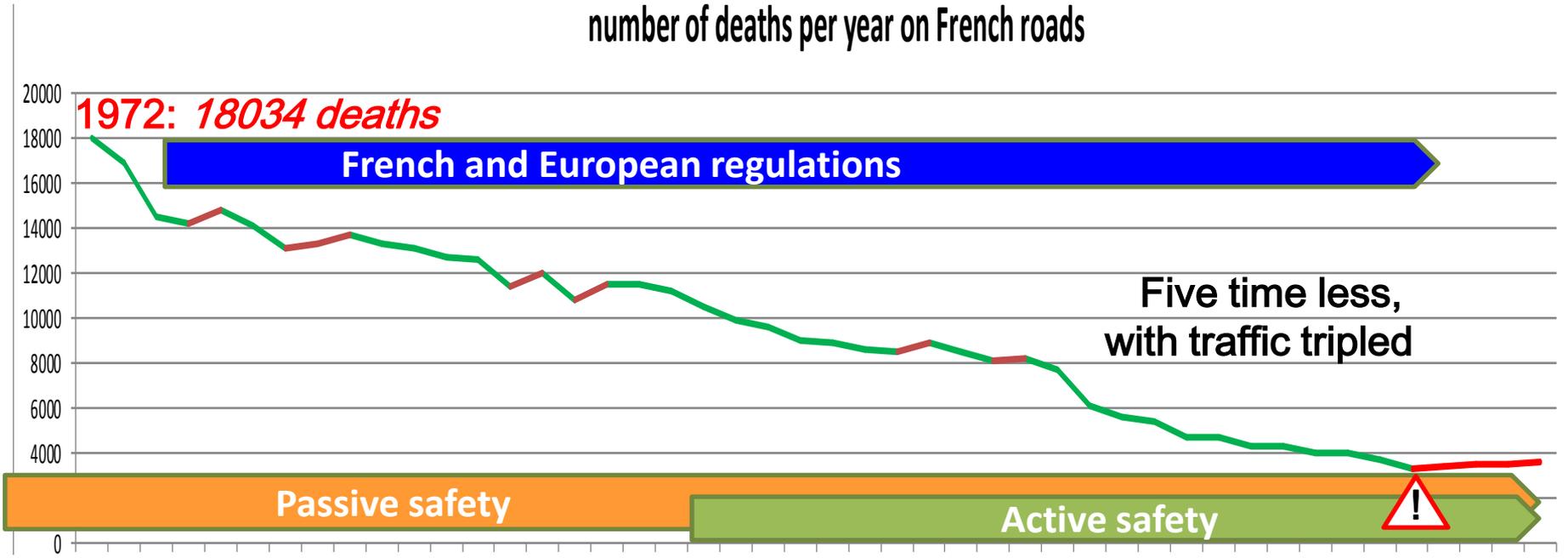
FROM PASSIVE TO ACTIVE SAFETY

De la sécurité passive à la sécurité active

Road Accidentology has first focused on passive safety:

Passive safety is a long story in France, with belt introduction and improvements, airbag multiplication, vehicle robustness to crashes... contributing with regulation to improvement.

number of deaths per year on French roads



1972: 18034 deaths

French and European regulations

Five time less, with traffic tripled

Passive safety

Active safety



1969 Renault-PSA LAB has been created in 1969, CEESAR in 1992. 2013: 3268 deaths

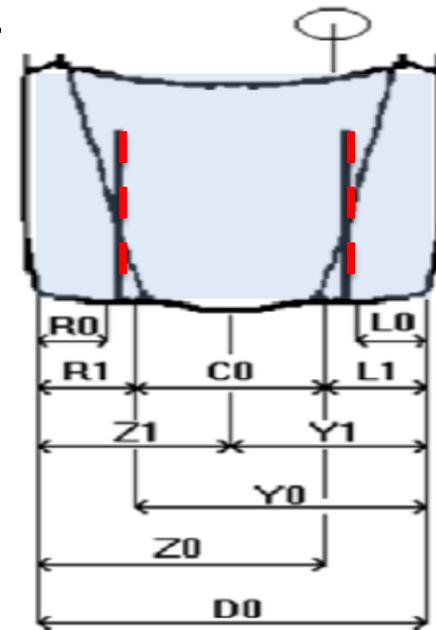
Priority to active safety but passive safety results have to be maintained, As accidents are not always avoided, as shown since 2013...

VOIESUR ACCIDENTOLOGY DATABASE

Base de données VOIESUR sur les accidents

A public-private project to get a real image of accidents in France:

From 2012 to 2015, a database has been built with sufficient parameters to replay accident scenarios and a statistical robustness based on 8500 accidents analysed, with hospital census to complete police data collection for injured persons.



Among the hundreds of parameters requested to replay accident scenario, the overlap percentage is measured, especially on frontal crashes. The **side members** are generally installed between 25 ($L0$) and 33% ($L1$) of the total width of the car.



FRONTAL CRASH REGULATION WITH DUMMIES

Réglementation des chocs frontaux avec mannequins

Initially built for total overlap, today based on 40%

New vehicles are tested with Hybrid III dummy, an old and well managed technology for frontal accidents: his longitudinal sensors are correlated with human physical limits in such crashes.



In Europe, this test has been replaced by a more demanding test based on the mean overlap, 40% on driver side, and the speed has been increased for EuroNCAP:

- The **side members have been reinforced** to support this crash alone, with impressive results, avoiding intrusion.
- The **hybrid III dummy has been tuned** to get sufficient representativity in such crashes .



DUMMY IMPROVEMENT FOR FRONTAL CRASH

Amélioration mannequin pour chocs frontaux

Increased bio-fidelity targets

Correlation analysis are made between dummies measured dynamic response and real human bodies* behaviour to identify the main gaps in terms of bio-fidelity.

Main targets are:

- To better reproduce the **submarining** characteristics of human body
- To adapt **abdomen sensors** versus real and frequent injury risks
- To get higher **thorax representativity** regarding airbag & safety belts
- To improve the global behaviour under **oblique deceleration**

The THOR dummy is under development, and still requires experimentation to reach bio-fidelity targets.
Its regulatory usage is not yet planned.



**: experimentation based on body donation to science, a French specific regulation*

Ex: WHEEL ANTI BLOCKING SYSTEM EFFECT

Exemple: impact du système antiblocage ABS

Active safety has begun with ABS, now generalised:

Active safety work has begun 30 years ago with ABS, to keep steering efficiency in emergency braking : the electronic control of the wheel speeds prevent blocking risk, allow urgency braking assistance and **optimise both braking distance and trajectory control.**



With real efficiency for all drivers in bad weather conditions, ABS has been generalized and is required by regulation since 2004. The vehicle park is renewed 5% / year in France, but most vehicles are now ABS, which will be the case on every market:

All drivers can now brake and steer brutally at the same time to avoid crashes.

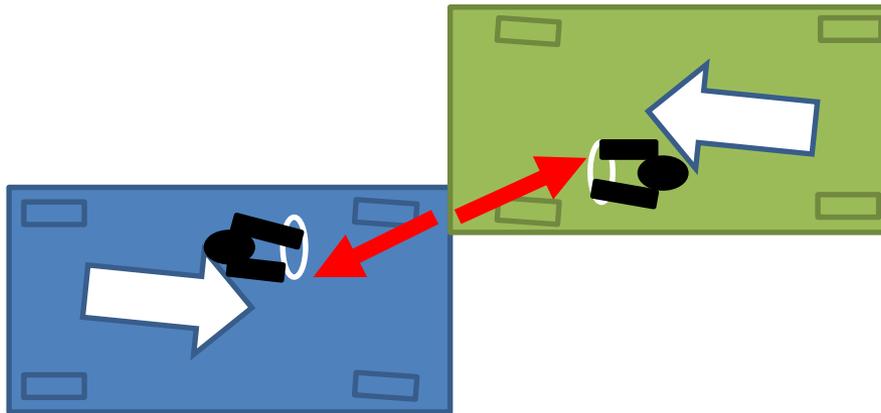
SMALL OVERLAP FRONTAL ACCIDENTS

Accidents à faible recouvrement

Specific case to be analysed with new tools...

Without ABS, **full overlap** was close to 20% of frontal accidents, and has been divided by 2 with ABS and emergency braking assistance.

Under 25% overlap, a frontal accident is considered as “**small overlap**”, more frequent with braking electronic control, but associated with lower Equivalent Energy Speed (EES) ...



Different from regulation test, this type of accident introduces **specific needs in terms of dummy and simulation, as oblique deceleration.**

HUMAN BODY MODEL POLYVALENCE

Polyvalence des modèles numériques du corps humain

Initially built for frontal tests, now adaptable



Global Human Body Model consortium

The “**50% driver**” human body model is used to test vehicles in regulatory situations, but is omnidirectional, so able to evaluate the impact of oblique decelerations.

Now, this Human Body Model can be modified :

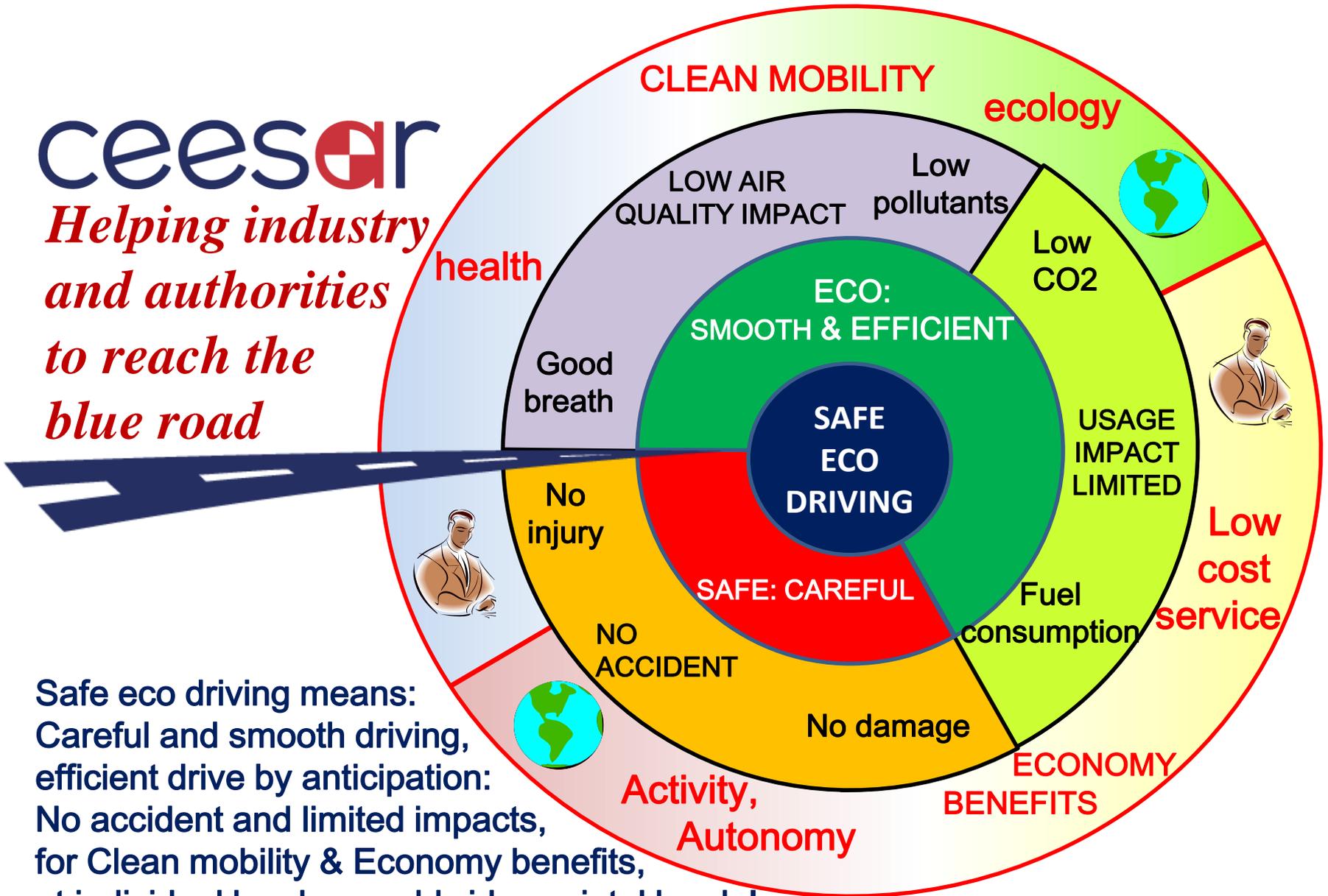
1. To represent the specific measurements of a real person, to replay a real accident or to **correlate the model with a real human body.**
2. To place the model in another place, a non-standard position or in a **pre-crash position before calculation.**

CONVERGENCE: now, the virtual testing is feasible because the tools are now available, but it is also necessary because of the evolution of the accidentology.

To get better results in accidents, cars have not only to be optimised with dummies, but also with a human body model, in a diversity of real accident scenarios.

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*Helping industry
and authorities
to reach the
blue road*



Safe eco driving means:
Careful and smooth driving,
efficient drive by anticipation:
No accident and limited impacts,
for Clean mobility & Economy benefits,
at individual level or worldwide societal level !