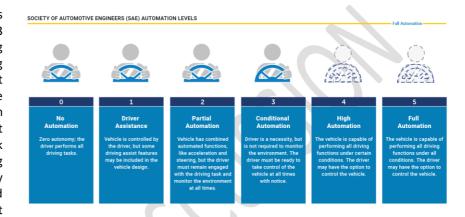# What is ACE?

ACE stands for Autonomous, Co-operative and Electric driving - three elements allowing to reach the full potential of automotive mobility that are also interrelated:
- Connectivity and co-operative systems are seen as additional sensors from an autonomous driving perspective
- Connectivity allowing real-time status information and the ability to reserve and pay for electromobility is essential to help overcome 'range anxiety'.

In autonomous driving, 5 levels are foreseen. From level 3 onwards, the automated driving system monitors the driving environment (not the driver). At level 4 the system (not the driver) supports fall-back in some driving environments. At level 5 monitoring and fallback are supported in all driving environments. Emergency braking, ABS, ESC, forward collision warning, blind spot warning and lane departure

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

0	1	2	3	4	5
No Automation	Driver Assistance	Partial Automation	Conditional Automation	High Automation	Full Automation
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

warning are examples of level 0 - no driving automation.
Parking assist, lane change and keeping assist, stop&go and adaptive cruise control are examples of level 1 - driver assistance.

Co-operative driving or 'C-ITS' stands for dozens of services (such as 'intersection collision avoidance') enabled by 'real-time' communication between vehicles (v2v) and between vehicles and the infrastructure such as traffic lights (v2i). At the European level the following groups of priority C-ITS services have been defined:

- Day 1 C-ITS services: warnings for danger zones (for slow or stationary traffic and queue tails), warnings for roadworks, (dangerous) weather conditions, emergency stops (activation of breaking lights), approaching emergency vehicles, in-vehicle messages, in-vehicle speed warnings, traffic light violations (intersection support), traffic light priority for emergency vehicles, speed advices, green waves, floating vehicle data, attenuation of shock waves.
- Day 1.5 C-ITS services: information about (alternative) fuel and charging stations, protection of vulnerable road users, on-street and off-street parking, park & ride information, co-operative navigation support (coordinated traffic lights), traffic information and re-routing.

Electromobility (e-mobility) is a general term for the development of electric-powered drivetrains designed to shift vehicle design away from the use of fossil fuels and carbon gas emissions. As such it includes full electric vehicles, as well as hybrid electric vehicles and those using hydrogen fuel cell technology. While electromobility designs are tied to the idea of smart power grids as improving the efficiency of the vehicle goes along with improving the efficiency of the grid, the main concern from an ITS perspective is visibility on the availability of the charging infrastructure as well as interoperable booking and payment mechanisms.

Relevance and market

Managing external effects

Autonomous driving improves safety by reducing accidents caused by human errors, increases transport system efficiency and reduces time in congested traffic while smoother traffic will also help to decrease the energy consumption and emissions of the vehicles. Autonomous driving also increases comfort (by freeing for other activities while driving) and increases social inclusion especially for elderly and impaired users.

Co-operative driving allows large efficiency gains (up to a doubling of the current road occupancy), safe driving (co-operative driving is a part of any 'zero-casualty' vision) and sustainable driving (road user charging internalising external costs is an example of a C-ITS service).

Electromobility is essential as transport represents almost a quarter of Europe's greenhouse gas emissions (and is the main cause of air pollution in cities); within the sector, road transport is by far the biggest emitter.

As 70% of trips in Belgium are made by car, and traffic models predict an increase to 80% by 2030, ACE technologies are considered vital for regional and urban traffic and road operators.

A huge market

The automotive market in Belgium is and will remain a huge market (more than 10 billion € per year) but it will undergo major changes. Annual vehicle sales will likely begin to decline in the next five to ten years as personal ownership of driver-driven vehicles declines and shared autonomous vehicles experience strong growth. But population growth and the accessibility of mobility for groups currently short of transportation options (adolescents, elderly, lower-income population segments, and people with disabilities) will likely cause total miles driven to increase by as much as 25 percent by 2040.

Link to ITS.be strategy

ACE is a top priority and an enabler of achieving the full potential of the automotive domain.

Overall, the ITS.be 2018-2021 strategy focuses on two markets and four priorities:
1. Intelligent vehicles
    1. Autonomous, Connected and Electrical vehicles (ACE)
    2. Road User Charging (RUC)
2. Seamless multimodality
    3. Mobility as a Service (MaaS)
    4. Multimodal Mobility Management by regions and cities (MMM)

Roles - stakeholders

The following stakeholders play a role in ACE:
*   Service providers - new players or existing providers of connected services such as navigation providers or breakdown assistance providers
*   OEMs - car manufacturers and their suppliers
*   Traffic and infrastructure operators - ranging from road infrastructure to electromobility
*   Authorities - federal, regional and urban authorities
*   Technology and connectivity providers - examples are providers of in-vehicle technology, providers of roadside technology and telecom operators
*   Knowledge centres - public and private research providers
*   Insurance companies - dealing with new liabilities
*   End users - for instance represented by mobility organisations.

Note
*   It is clear that OEMs and their suppliers play a central role in ACE.

- Autonomous, C-ITS and electric driving are also priorities at the European level.

Need for a platform

A neutral ACE platform is needed, because of:
- the multitude of stakeholders
- policy-instruments at different levels (federal, regional, urban)
- the need for public-private cooperation.

As such, the platform should:
- be open
- focus on
  - exchanging the emerging best practice
  - realising enablers - such as the promotion of "Visible C-ITS demonstrators".

For autonomous, co-operative and electrical driving several obstacles and unclarities should still be resolved. As an example, there is a tension in C-ITS between two sets of technologies that are each more or less suitable for specific C-ITS services:
- cellular technologies (3G, 4G, LTE 5G and when it becomes available) for which the scale of existing deployment, the continuous improvements and working business models are considered as the main advantages
- local (beacon-based) technologies (ETSI ITS-G5, DSRC, 802.11p) that exchange data between the vehicle and the infrastructure (and between vehicles) on the basis of frequencies and protocols that are specifically designed for C-ITS services (characterised by guaranteed, fast response times).

Alignment in a public-private setting with all stakeholders involved is essential; probably, both technologies can be put on the same converging roadmap with each technology playing a complementing role.

Action plan

In this plan, overall goals, 2018-2019 targets and specific actions are proposed to help overcome the four categories of obstacles mentioned before. As they are related, action points for ACE and *Road User Charging* are shown below *(the last one in italics).*

The following types of actions are repeatedly used below:
1. Position papers are the basis for later co-operation and communication (B2B, B2C, B2P)
2. (High-level) Meetings are targeted encounters, in which only direct stakeholders are involved with the goal to come to an agreement
3. (Open) Workshops are open to all stakeholders and intend to lead to consensus
4. Repositories are websites with best-practice documents or examples.

Overall goal
- ACE - Autonomous, Connected and Electrical vehicles:
  - help accelerate the introduction of autonomous, connected and electrical vehicles in Belgium
  - facilitate access to in-vehicle data and for third-party services
- *RUC - Road User Charging extensions: help develop an interoperable framework for road charging across regions and cities in Belgium (eg for extension of the current truck charging scheme to other classes of vehicles for goods transport, or for extension to private cars).*

2018-2019 targets for enablers
1. **Help organise a visible C-ITS demonstrator**
2. **Collect tender examples for C-ITS day-1 services**
3. **Develop a common position for a legal framework for connected and later autonomous vehicles**

4. **Identify testing requirements for tendering C-ITS services.**

2018 actions

- Awareness:

  o **Write a common position paper on autonomous, connected, and electrical vehicles**
  Including benefits and best practice recommendations.

  o **Create a repository on European calls**
  Support matchmaking between companies and authorities.

  o **Organise an open workshop on innovative procurement covering C-ITS**
  Leading to best practice recommendations.

  o *Write a common position paper on road user charging*
  Including benefits and best practice, fiscal and technical recommendations.

  o **Organise a visible C-ITS demonstrator**
  Relying on initiatives that the Belgian regions are already involved in.

  o **Organise an open workshop on the vision and research agenda**
  What are the long-term vision, impact and implications behind ACE, also in 'dependent' domains such as urban planning, and what relevant unknowns and research needs be derived from this? (possibly combined with the related MaaS workshop).

- Business enablers:

  o **Organise an open workshop on "in-vehicle access to third-party services"**
  With the car manufacturers, key suppliers and third-party service providers and leading to an accurate description of the state of the art.

  o **Organise a high-level meeting on the Belgian position on access to in-vehicle data**
  With federations (of car manufacturers and dealers) and regional, federal and European authorities and leading to best practice recommendations.

  o **Organise an open workshop on the use of C-ITS in regional tenders**
  Involving the regional road operators and industry and leading to best practice recommendations.

  o **Organise a high-level meeting on the use of Viapass FCD by traffic centres**
  Leading to practical steps forward.

  o *Organise an open workshop on the findings of the Flemish region for road user charging*
  Leading to recommendations on how to successfully migrate towards road charging for private cars.

  o **Organise a high-level meeting on how to automatically forward eCall data to traffic centers**
  Leading to practical steps forward.

- Legal and fiscal enablers:

  o **Organise an open workshop on new legislation needed for autonomous vehicles**

A legal framework for first tests with autonomous vehicles exists. There is still a long way to go to arrive a legal framework for driving production autonomous vehicles.

- Technical enablers:

  - **Demonstration of possible test requirements for day1 C-ITS services**
    A pre-condition for tendering C-ITS equipment and services.

Implications for policy makers

From the above, the following policy recommendations can be derived:

- All levels
  - A legal framework for autonomous driving
  - Harmonised tenders for C-ITS technology
  - In mobility plans, it should be explicitly foreseen that it will be checked whether
    - an open data component should be added to new (or updates of) tenders or concessions for electromobility
    - access to reservation and payment should be added to new (or updates of) tenders or concessions for electromobility
  - Alternatively this should be foreseen by law.

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Participants

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