



# Autonomous Vehicles & Connected Vehicles: Challenges for Motorway Operation Companies

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## Introduction

Car industries are developing technologically-advanced vehicles to deal with current challenges:

- Road Crashes: 1.2 million deaths / year & Injuries & Material Damages



2-3% of Gross World Product (GWP) \*

- Traffic Congestion
- Global Warming / Air Pollution

\* Source: World Health Organization (WHO)



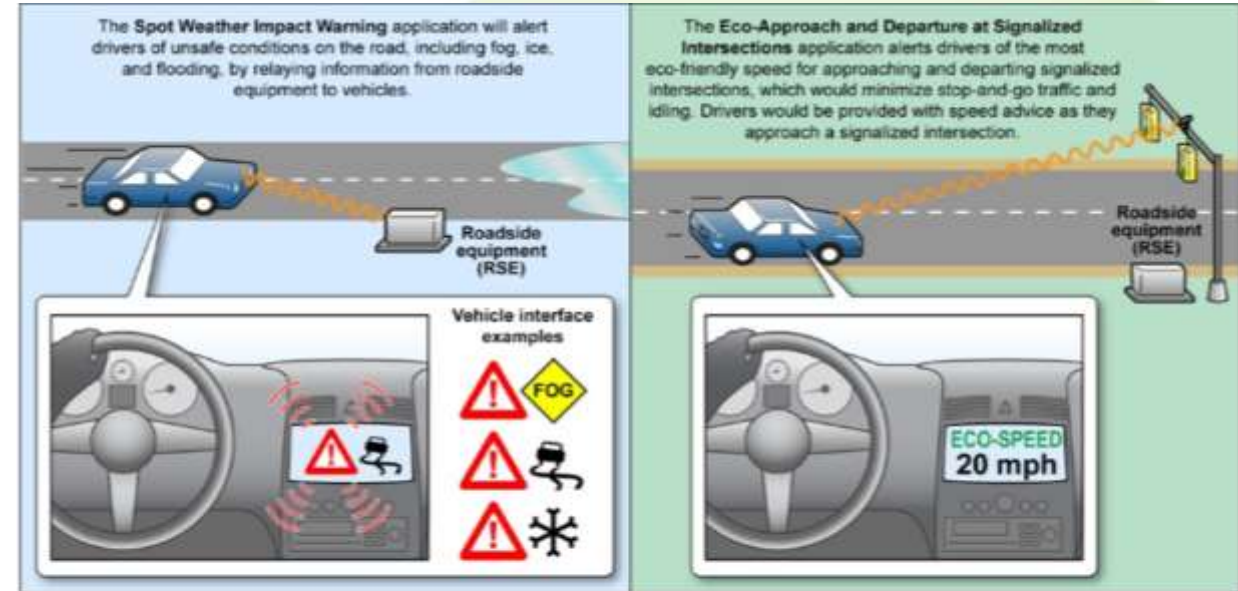
# What are Connected Vehicles?

Connected vehicles are vehicles that provide connection to at least one of the following:

- The Internet
- Other vehicles (V2V)
- Infrastructure (V2I)
- Everything (V2X) i.e. Internet – Vehicles – Infrastructure – Devices – Pedestrians – Grid

# Applications of Connected Vehicles

- Navigation assistance
- Front-collision warning
- Lane-departure warning
- Intersection assistance
- Left-turn assistance
- Park assistance / Park garage pilot
- Highway pilot
- Red signal violation warning
- Weather conditions warning (fog, snow, ice)
- Eco-approach at signalized intersections

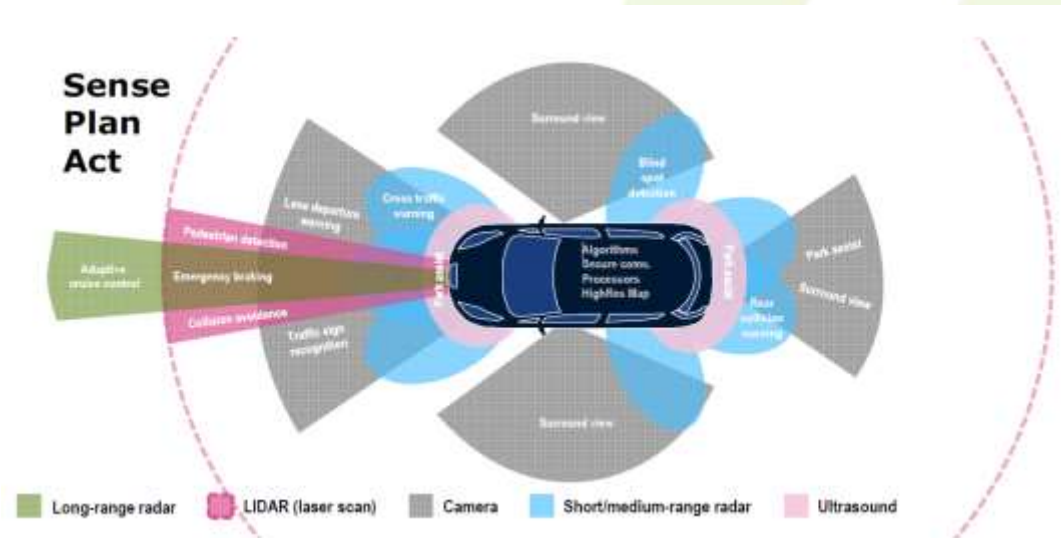


Source: United States Government Accountability Office Report to Congressional Requesters. Intelligent Transportation Systems (September 2015)

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# What are Autonomous Vehicles?

- The evolution of connected vehicles will lead to vehicles that will not need human operation, called "Autonomous Vehicles".
- Autonomous Vehicles will perceive their surroundings through Radar, Lidar, GPS, odometry and machine vision.



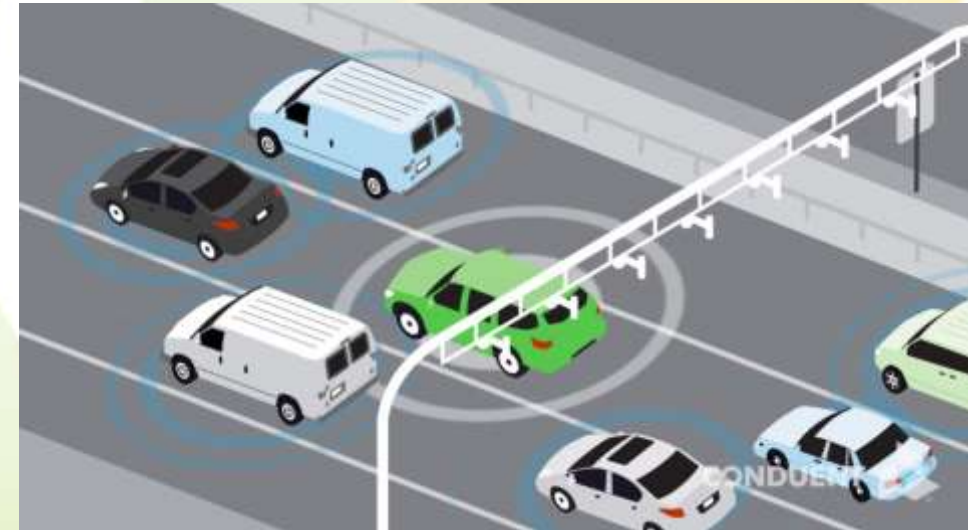
Source: International Transport Forum (2015)

# Advantages of CAVs

- Travel time reduction / ease in finding parking space
- Truck platooning / reduced costs of transporting goods
- Better traffic control and incident management
- Ease in toll collection
- Reduction of crashes / fatalities / injuries
- Fewer greenhouse emissions



Source: Logisticsmanager.com (2016)





## Disadvantages of CAVs

- Possibility of cyber attack
- Reluctance/resistance to release control of vehicle to a computer
- Significant cost of installation and maintenance of road-side equipment
- Risk of ignoring safety instruction/alert (e.g. seatbelt) or overall lack of attention
- Driver inexperience in case of need to take control of the vehicle



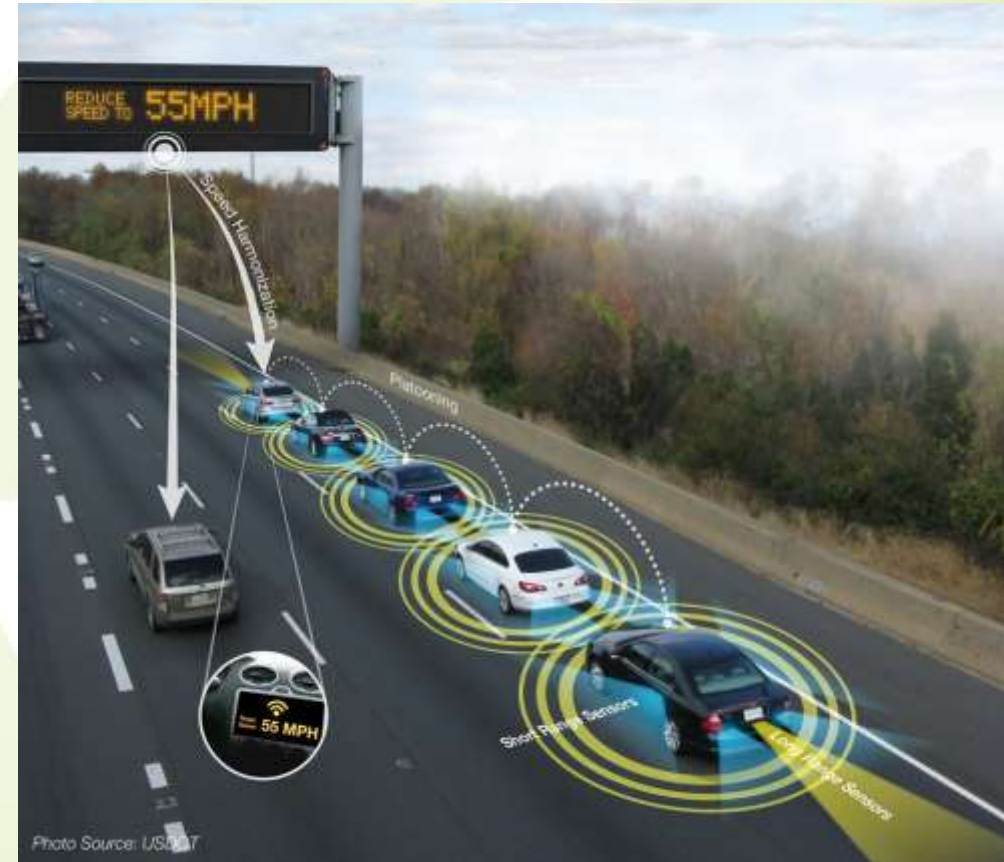
# Main questions to be answered

- Legal and regulative framework:
  - Who will be responsible for a crash? The driver? The automaker? The programmer?
- Influence of autonomous fleet on transport design and road operation:
  - Fewer/narrower highway Lanes? Mixed traffic?
- Cost of equipment:
  - Who is going to pay for installation and maintenance? The State? The operator? The Concessionaires?
- Developing technical standards / interoperability
- Driver training? Age limits? Need for driver to oversee autonomous systems?



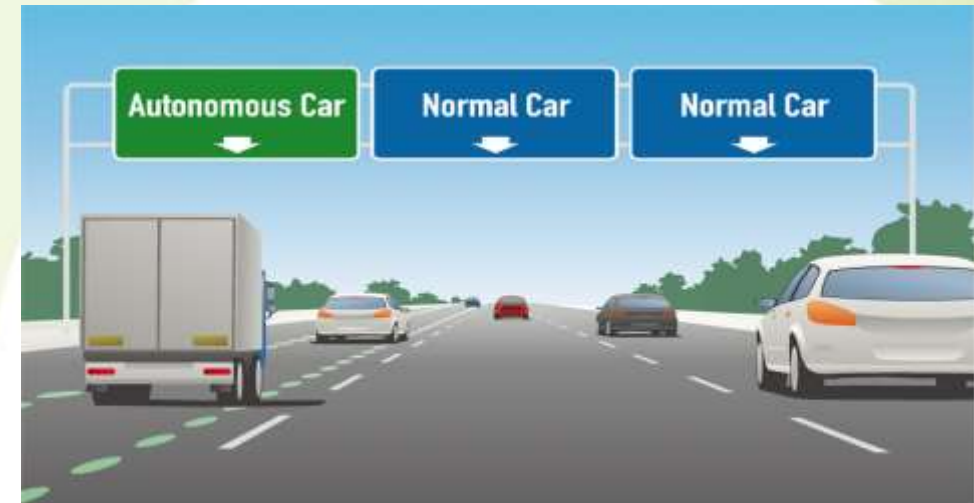
# CAVs and conventional vehicles - mixed traffic

- Simultaneous existence of conventional and CAV vehicles in the same road seems very complex. The reason is that driving attitude will be different, such as safety distance, braking distance etc.
- For that reason, separation of traffic is recommended.



# CAVs and conventional vehicles - Lane separation

- Use of the left lane only for CAVs or in combination with other categories (High Occupancy Vehicles, emergency vehicles etc.)
- Installation of sensors in the left lane to communicate with vehicles for safety maximization.
- Surveillance of left lanes? Cameras? Police? Use of lane separators? Fines?



Source: Inhabitat.com (2016)



# Creation of a Think Tank to promote sustainable transport and mobility

- Members will be road operators, state authorities, software companies, universities and other stakeholders.
- The mission will be: exchange of ideas, formation of common positions, networking for problem solutions, participation in R&D and pilot applications.
- A challenging start could be the development of pilot application for new technologies and CAVs on motorways, as motorways offer a well protected environment.



## Conclusions

- Car industries are currently performing many tests/pilots of CAV technologies.
- It is essential to ensure that tests are performed in real conditions for better integration of technologies and risk identification.
- Stakeholders need to cooperate with road operators for maximization of the advantages of CAVs.
- The road operators have to follow the vehicle evolution and adapt to the new technologies.



*Thank you for your attention!*

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