

PIARC International Conference on Road Tunnel Operations and Safety



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Using ITS to improve safety in road tunnels

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Human factors and ITS

Agenda

What is ITS?

Applications for self-driving vehicles

- SAE Classification Scale
- Goods transportation
- People transportation
- Challenges

Connected vehicles and C-ITS

Opportunities and challenges for tunnels

Summary

What is ITS?

ITS stands for Intelligent Transportation Systems

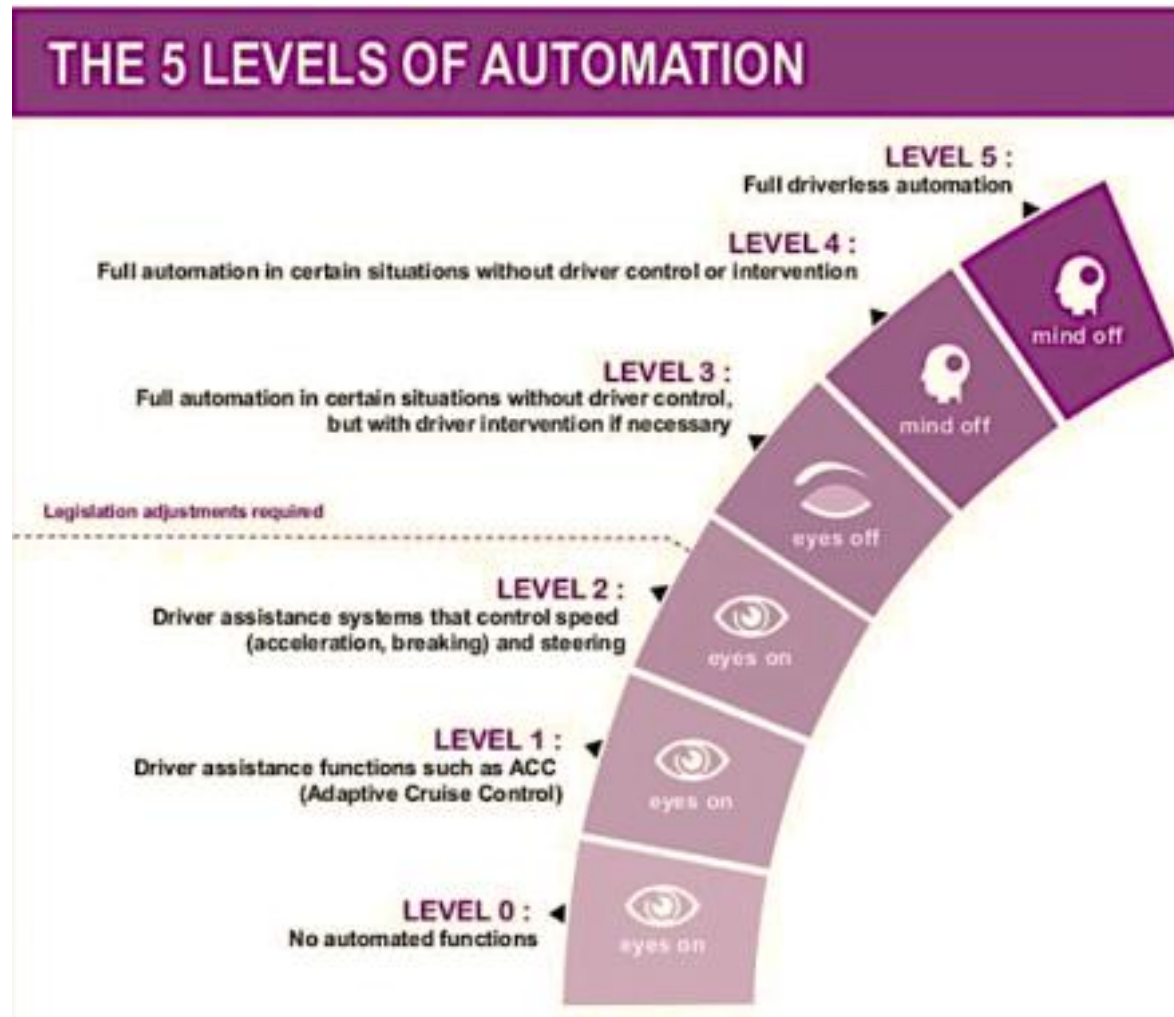
- Information and communication systems and technologies applied on ground transportation

Today and the future

- Safety systems
- Self-driving vehicles (automated)
- Connected and cooperative vehicles, C-ITS

Applications for self-driving vehicles

SAE Classification Scale



Goods transportation

Single vehicles and platoons on highways

Docking/undocking

Service vehicles

Single vehicles in mines

Aftermarket solutions

- Singe vehicles
- Platoons

New types of utility services



Mercedes: Partly automated production model tested



ZF: Fully automated remote truck docking



Kamaz: Partly automated production model



Royal Truck & Equipment: Fully automated impact protection



Volvo: A refuse truck in urban environment



Caterpillar: Fully automated mining truck



Freightliner: Fully automated Inspiration Truck.



Peterbilt: Advanced driver assistance system



Scania: Highway truck platooning



Uber: Automated mobility service on highways



Peloton: Aftermarket solution for platoons on highways



tuSimple: Automated mobility service on highways



Embark: Single truck driving on highways



Mercedes Benz: A nest for delivery drones



This isn't just a company. It's a movement.

Einride is installing the world's first completely emission-free, road-based transportation system. We are rethinking the entire transport infrastructure from the ground up, creating the transport solution of the future.

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People transportation

Focus on

- Selected highways
- Automated parking
- Mobility as a service



Tesla: Automated highway driving & autonomous parking for existing models.



Volvo Cars: Automated highway driving in Sweden, China, the UK.



Ford: No steering wheel for taxi services by 2021. Start selling to ordinary customers by 2025.

Toyota: Automated highway driving, to be commercialized in 2020.



Audi: Start selling cars able to communicate with traffic lights by 2017.



Challenges for self-driving vehicles

Business models

Interaction with people

- Automated Vehicle Interaction Principles

Cybersecurity

Rules of the road

Safety assurance

- Traffic efficiency

Technology improvement

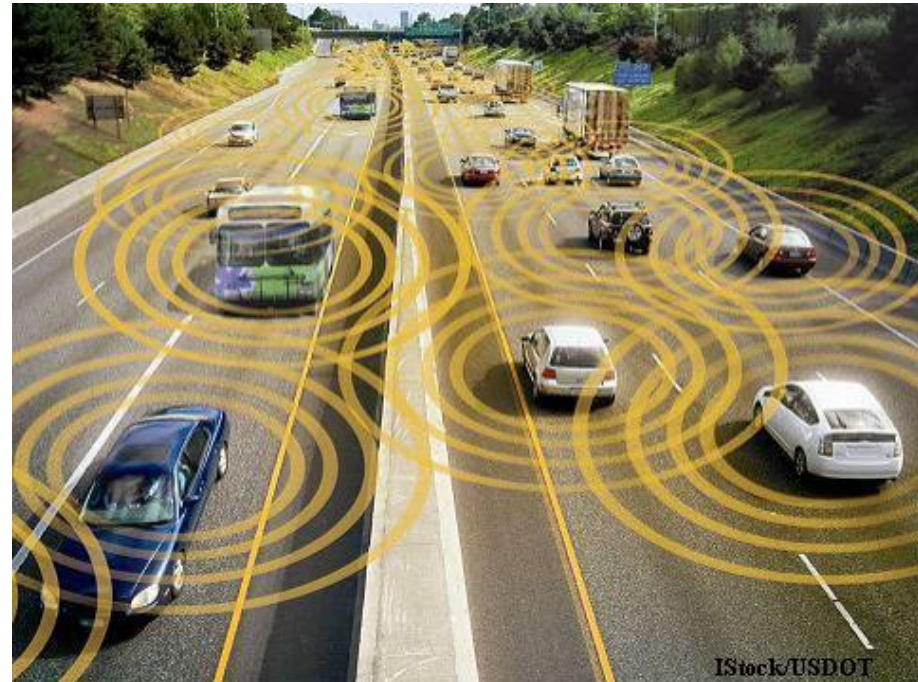
Connected vehicles and C-ITS

Cars are connected today

- Cellular
- Upcoming technologies
e.g. ITS-G5 and 5G

C-ITS

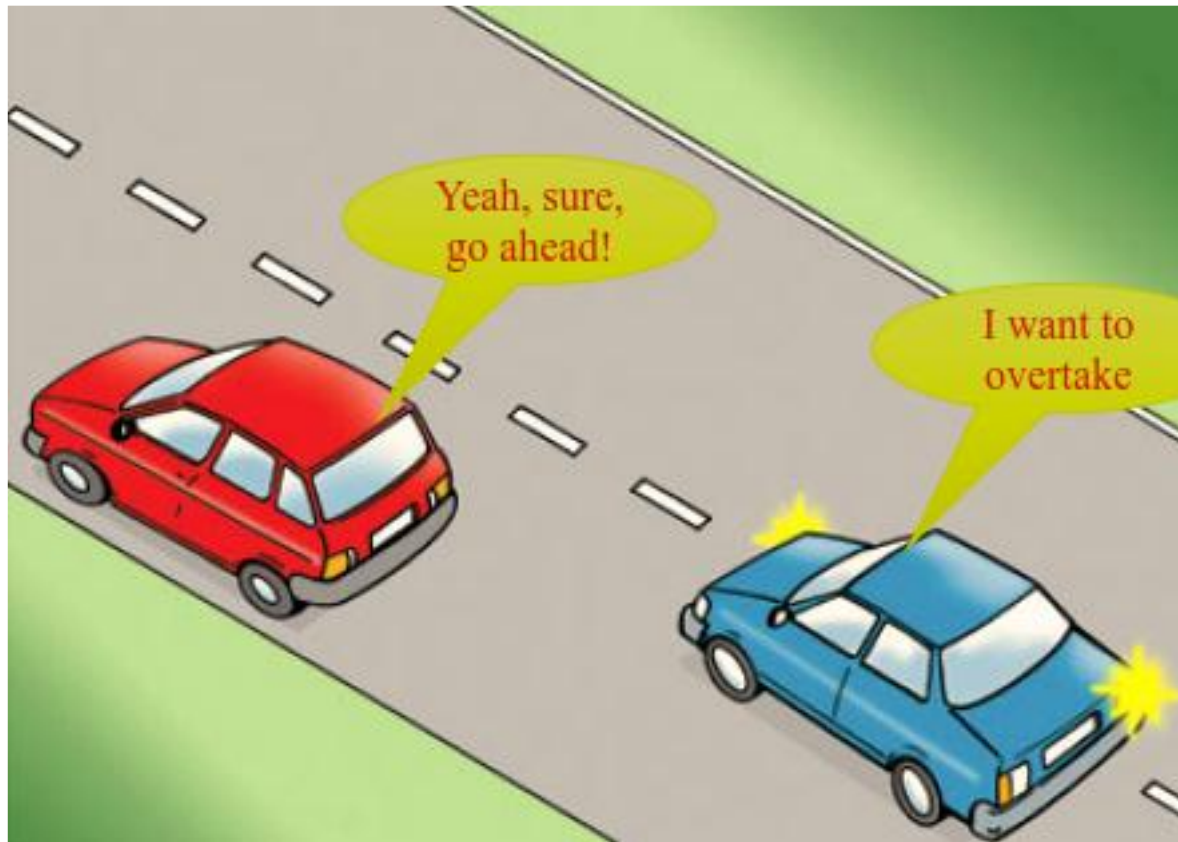
- Connected
- Automated
- Zero fatalities
- Zero emission



ISTock/USDOT

Connected vehicles and C-ITS

Connected → Cooperative



Source: RISE Viktoria

Opportunities and challenges for tunnels

Driving conditions

- Normal, pre-crash and post-crash

General challenges

- Restricted geometry
- Propagation issues of wireless signals
- Loss of satellites
- Electrical vehicles
- Emergency response

Opportunities and challenges for tunnels

Challenges for self-driving vehicles in tunnels

- Road markings
- Lighting conditions
- Emergency response process
- Fire and smoke detection and recognition

Other challenges

- Platooning
- Data
- Mix of vehicles

Opportunities and challenges for tunnels

C-ITS opportunities

- Vehicle to vehicle communication V2V
 - Safe distance with heavy goods vehicles
 - Notification of dangerous goods vehicles
- Vehicle to infrastructure communication V2I
 - Notification of road, traffic and vehicle condition
 - Dissemination of tunnel topology, e.g., exit location
 - Vehicle coordination through control centers
 - Road works, incident ahead and other hazards

Opportunities and challenges for tunnels

Other opportunities

- Persons with reduced mobility
 - Notification of type of impairment
 - Location
 - Service request
- Evacuation management
- Incident management
- Dynamically assigned lanes

Summary





Thank you for your attention