Using ITS to improve safety in road tunnels

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PIARC TC D.5 WG 3
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

THE 5 LEVELS OF AUTOMATION

LEVEL 5:
Full driverless automation

LEVEL 4:
Full automation in certain situations without driver control or intervention

LEVEL 3:
Full automation in certain situations without driver control, but with driver intervention if necessary

LEVEL 2:
Driver assistance systems that control speed (acceleration, breaking) and steering

LEVEL 1:
Driver assistance functions such as ACC (Adaptive Cruise Control)

LEVEL 0:
No automated functions
Goods transportation

Single vehicles and platoons on highways
Docking/undocking
Service vehicles
Single vehicles in mines
Aftermarket solutions
  - Single 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
<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
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<tr>
<td>Uber</td>
<td>Automated mobility service on highways</td>
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<tr>
<td>Peloton</td>
<td>Aftermarket solution for platoons on highways</td>
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<tr>
<td>tuSimple</td>
<td>Automated mobility service on highways</td>
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<tr>
<td>Embark</td>
<td>Single truck driving on highways</td>
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<tr>
<td>Mercedes Benz</td>
<td>A nest for delivery drones</td>
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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.
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
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