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Jornada sobre Conducción Autónoma en España

Connectivity and Automated Driving

M2F Plenary Meeting 2015
11th March 2015 – Madrid

Innovation in Road Transport for
Europe Competitiveness

Definición de los Niveles de Automatización

Summary of Levels of Driving Automation for On-Road Vehicles

This table summarizes SAE International's levels of *driving* automation for on-road vehicles. Information Report J3016 provides full definitions for these levels and for the italicized terms used therein. The levels are descriptive rather than normative and technical rather than legal. Elements indicate minimum rather than maximum capabilities for each level. "System" refers to the driver assistance system, combination of driver assistance systems, or *automated driving system*, as appropriate.

The table also shows how SAE's levels definitively correspond to those developed by the Germany Federal Highway Research Institute (BAST) and approximately correspond to those described by the US National Highway Traffic Safety Administration (NHTSA) in its "Preliminary Statement of Policy Concerning Automated Vehicles" of May 30, 2013.

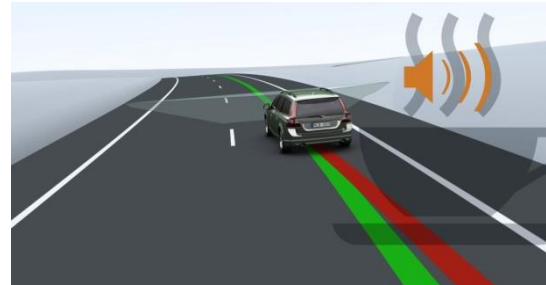
Level	Name	Narrative definition	Execution of steering and acceleration/ deceleration	Monitoring of driving environment	Fallback performance of <i>dynamic driving task</i>	System capability (<i>driving modes</i>)	BAST level	NHTSA level
<i>Human driver</i> monitors the driving environment								
0	No Automation	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	Driver Assistance	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	Partial Automation	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	System	Human driver	Human driver	Some driving modes	Partially automated	2
<i>Automated driving system</i> ("system") monitors the driving environment								
3	Conditional Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> with the expectation that the <i>human driver</i> will respond appropriately to a <i>request to intervene</i>	System	System	Human driver	Some driving modes	Highly automated	3
4	High Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a <i>request to intervene</i>	System	System	System	Some driving modes	Fully automated	3/4
5	Full Automation	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	All driving modes		

Definición de los Niveles de Automatización

Current and future vehicle Systems – Level 0

LDW: Lane Departure Warning

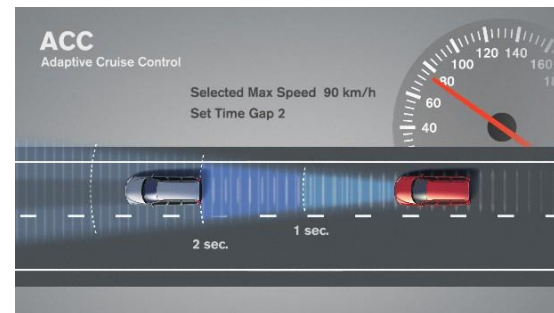
Lane Departure Warning helps to prevent accidents caused by unintentionally wandering out of lane, and represents a major safety gain on motorways and major trunk roads. If there is an indication that the vehicle is about to leave the lane unintentionally, the system alerts the driver visually and in some cases by means of a signal on the steering wheel.



Current Systems –Level 1

ACC – Adaptive Cruise Control

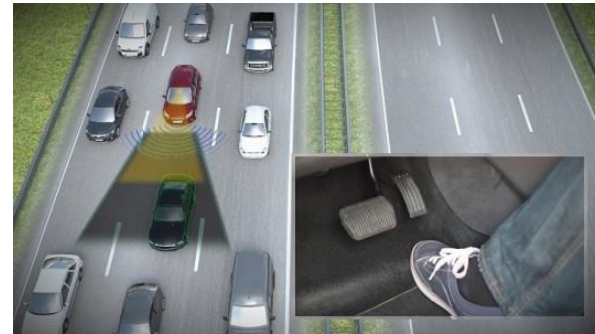
The cruise control system with “automatic distance control ACC” uses a distance sensor to measure the distance and speed relative to vehicles driving ahead. The driver sets the speed and the required time gap with buttons on the multifunction steering wheel or with the steering column stalk (depending on model). The target and actual distance from following traffic can be shown as a comparison in the multifunction display.



Definición de los Niveles de Automatización

Highway Pilot. Traffic Jam Assist (level 2)

The function controls the vehicle longitudinal and lateral to follow the traffic flow in low speeds (<30km). The system can be seen as an extension of the ACC with Stop&Go functionality. (i.e. no lane change support).



Highway Chauffeur (Level 3)

Conditional Automated Driving up to 130 km/h on motorways or motorway similar roads. From entrance to exit, on all lanes, incl. overtaking. The driver must deliberately activate the system, but does not have to monitor the system constantly. The driver can at all times override or switch off the system. The system can request the driver to take over within a specific time, if automation gets to its system limits.



Definición de los Niveles de Automatización

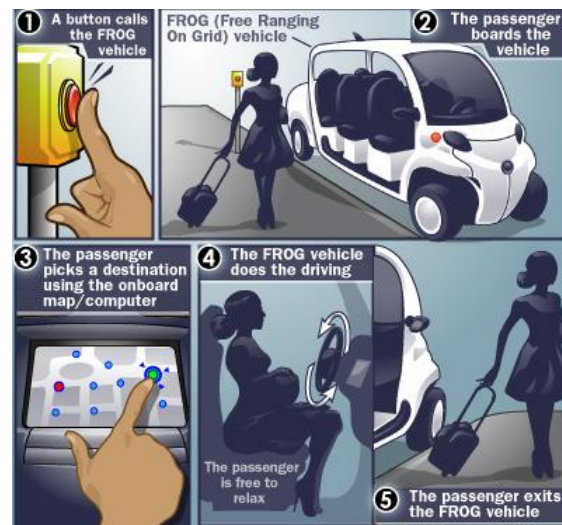
Highway Pilot (level 4)

Automated Driving up to 130 km/h on motorways or motorway similar roads from entrance to exit, on all lanes, incl. overtaking and lane change. The driver must deliberately activate the system, but does not have to monitor the system constantly. The driver can at all times override or switch off the system. There are no request from the system to the driver to take over when the systems in normal operation area (i.e. on the motorway). Depending on the deployment of cooperative systems ad-hoc convoys could also be created if V2V communication is available.



Fully automated private vehicle (level 5)

The fully automated vehicle should be able to handle all driving from point A to B, without any input from the passenger. The driver can at all-time override or switch off the system. Note: no realistic time estimation exists on this system.



Connectivity and Automated Driving

- Task Force created by ERTRAC in June 2014
- Call for experts within ERTRAC members: industry, European associations, research providers, EU Member States + EC DG R&I/MOVE/CNECT
- 1st workshop 8 July 2014: gather experts; set the scene
- 2nd workshop 8 October 2014: propose roadmap structure and main chapters
- Draft 1.0 for consultation (sent 31 October 2014)
- Draft 2.0 after consultation (sent 3 December 2014)
- 3rd workshop 11 December 2014
- 4th workshop 26 January 2015
- Public presentation at ERTRAC Conference 3 March 2015



Roadmap Document

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European Activities (Chapter 5)

Member State contributions:

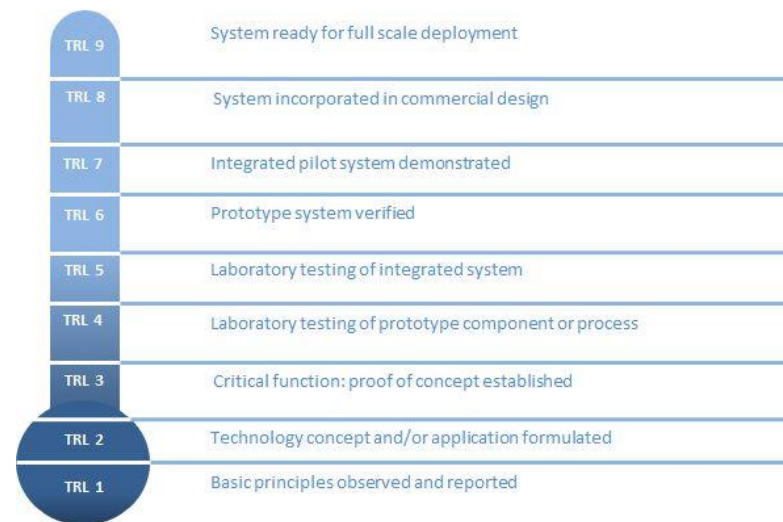
- France
- Germany
- Spain
- Sweden
- The Netherlands
- United Kingdom



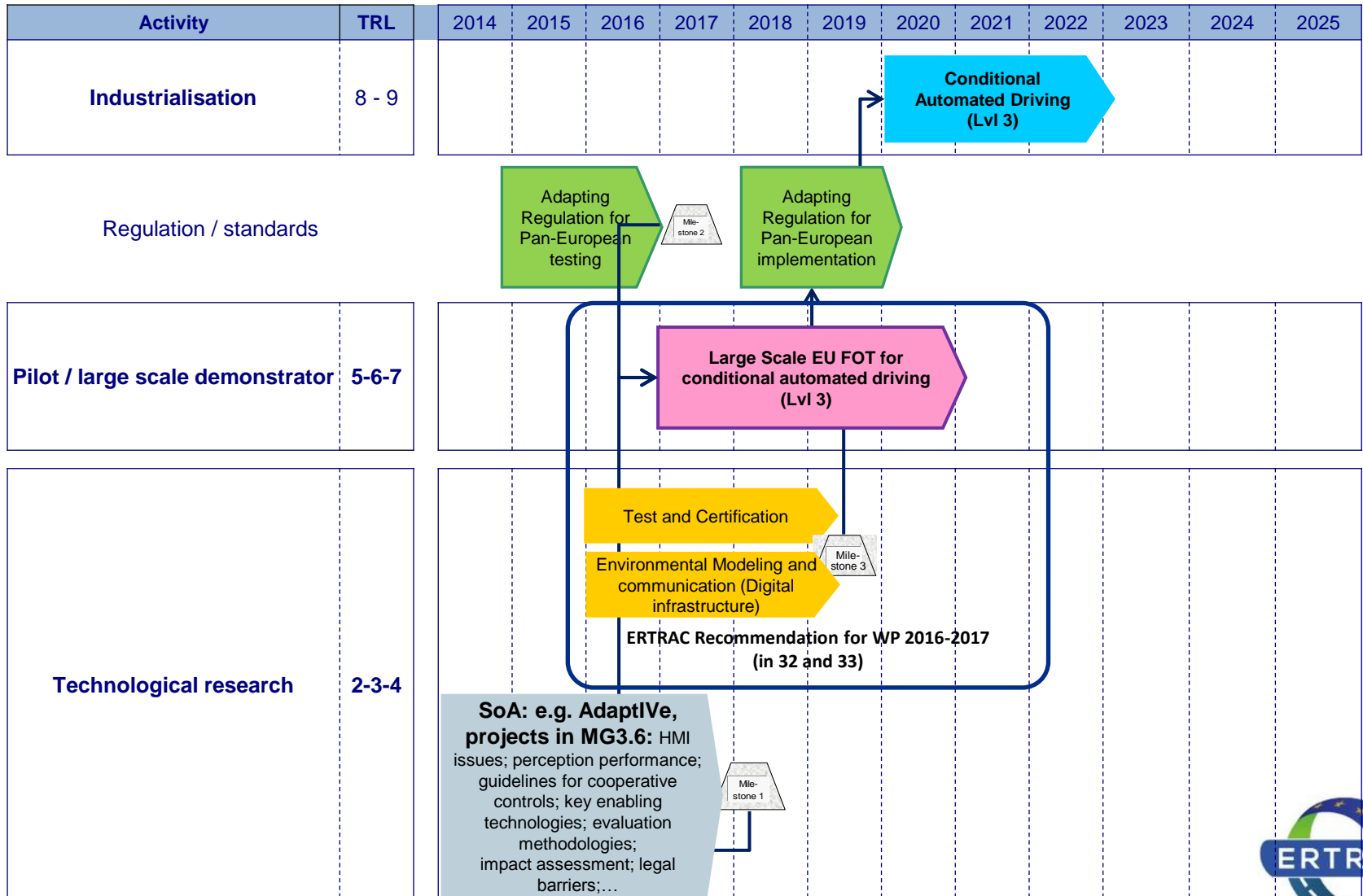
Roadmap Development

Objectives:

- Comprehensive, clear, rememberable;
- Keep it simple;
- **TRL-based approach;**
- Clear target for implementation;
- Overall number of roadmaps should be reasonable;
- Consider the state of the art.



Conditional Automated Driving



Automated Urban Road Transport

Activity	TRL	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Industrialisation	8 - 9										Automated Urban Road Transport (Lvl 4/5)		

Regulation / standards

Pilot / large scale demonstrator	5-6-7												
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Technological research	2-3-4												
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CityMobil2,
MG3.6, ECSEL,
Design Guidelines;
legal framework
proposal;
Showcases;
Sensors

ERTRAC Recommendation for WP 2016-2017 (in 32 and 34)

Technical solutions
for perception and
connectivity enabling
safety and acceptance
or automated urban
road transport

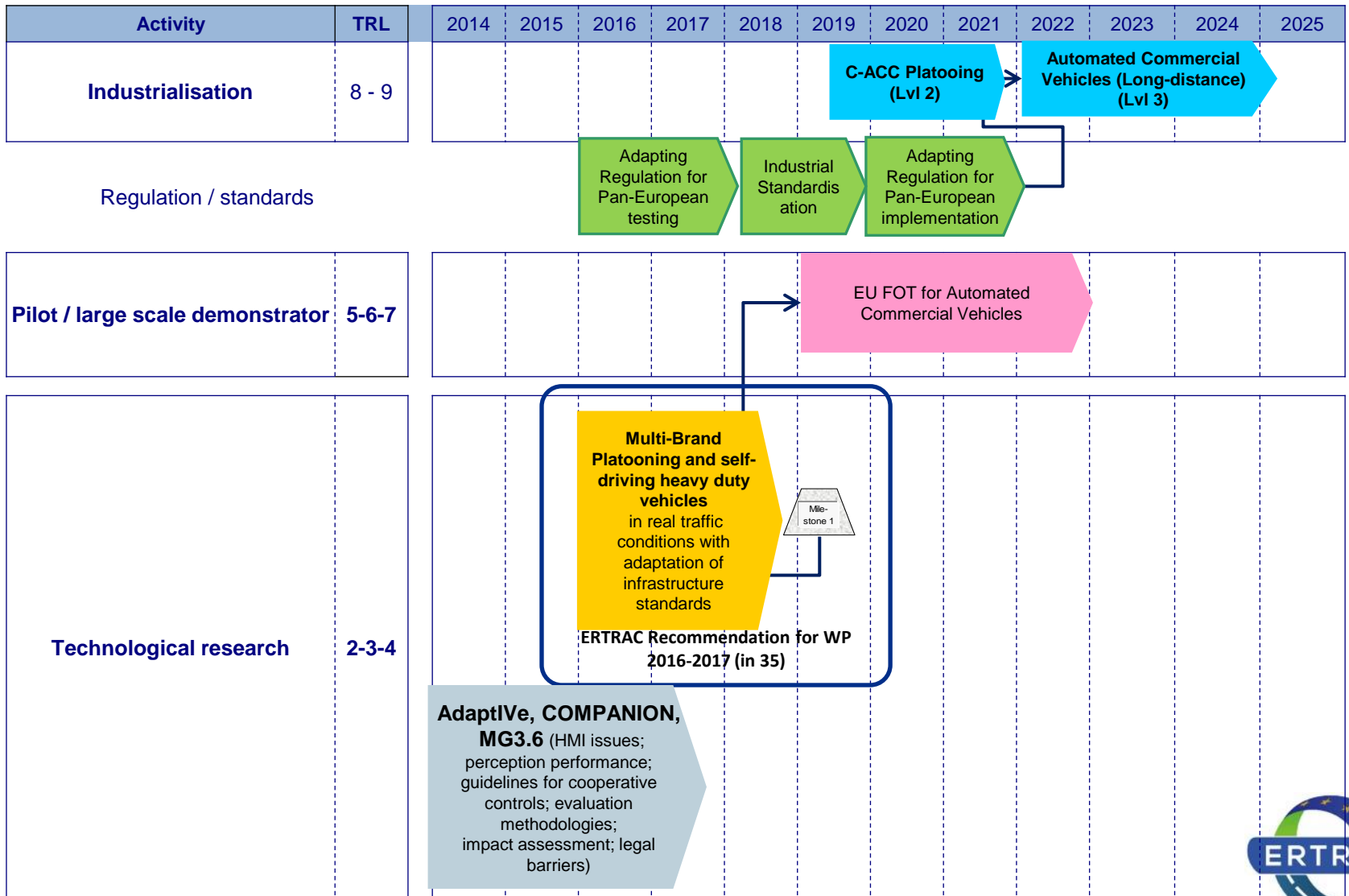
Large scale demonstration of
urban road transport
automation integrated with
existing public transport

Adapting
Regulation
for Lvl 4/5

Automated Urban Road
Transport (Lvl 4/5)



Automated Commercial Vehicles



Recommendations



Framework & Solutions for Safe Automated Road Transport



Enabling functionalities from Partial Automation to Conditional Automation



Large scale demonstration of urban road transport automation integrated with existing public transport



Platooning and self-driving heavy duty vehicles in real traffic conditions with adaptation of infrastructure standards

