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ARCADE consolidated Roadmap 2019

Joint stakeholder workshop Feb 13, 2020

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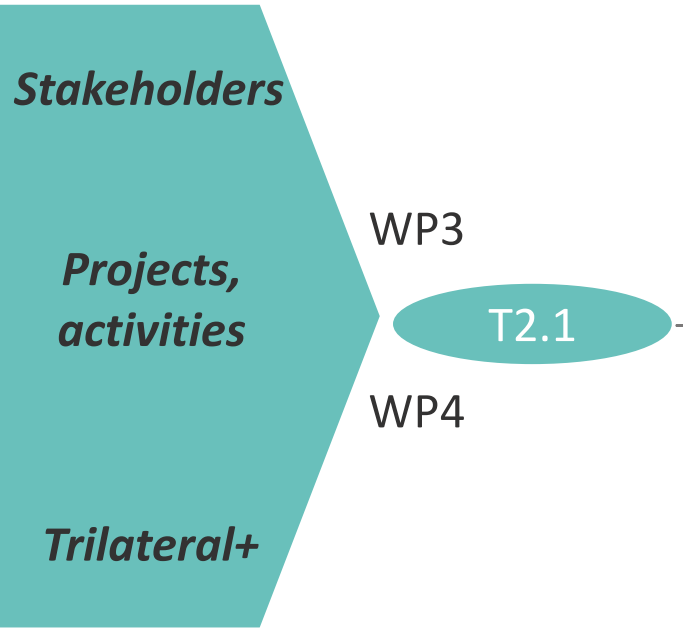
the European Union Horizon 2020
Work Programme

ARCADE Consolidated Roadmap 2019 - Relationships



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↔ **CCAM** single platform

↔ **STRIA** CAT 2.0 *(+ Urban Mobility, Infrastructure, ...)*

↔ **ERTRAC WG CAD** *(+ Safety&Security, Long distance - freight transport, Urban Mobility)*

↔ **CEDR, ALICE** *and other stakeholder roadmaps and strategy documents*

↔ **National Roadmaps**

↔ **International Roadmaps**

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Automated Passenger Car Development Paths

Automation Level	Established	2018	2020	2022	2024	2026	2028	2030	...
Level 5: Full Automation									**Fully Automated Passenger Cars**
Level 4: High Automation				**Urban and Sub-Urban Pilot**					
				Highway Autopilot including Highway Convoy					
Level 3: Conditional Automation					**Highway Chauffeur**				
					Traffic Jam Chauffeur				
Level 2: Partial Automation	**Traffic Jam Assist** **Parking Assist**								
Level 1: Driver Assistance	**Adaptive Cruise Control** **Stop &Go** **Lane Keeping Assist** **Lane Change Assist** **Parking assist**								
Level 0: No Driving Automation, support beyond human capability to act	**Lane Departure Warning** **Blind-spot Warning** **Forward Collission Warning** **ABS, ESC** **Emergency Brake**								

Indicative development paths TRL 7-9

Passenger Cars: M1 category

Highway Autopilot (Level 4)

Highway Convoy (Level 4)

Urban and Suburban Pilot (Level 4)

Automated Freight Vehicle Development Paths

Automation Level	Established	2018	2020	2022	2024	2026	2028	2030	...
Level 5: Full Automation									**Fully Automated Freight Vehicles**
Level 4: High Automation			**Highly Automated Vehicles in Confined Areas**		**Highly Automated Vehicles on Dedicated Roads**		**Highly Automated Vehicles on Open Roads**		
					Highway Pilot Platooning				
Level 3: Conditional Automation				**Highway Chauffeur**					
			Traffic Jam Chauffeur						
Level 2: Partial Automation					**Automated Truck Platooning**				
		Traffic Jam Assist							
Level 1: Driver Assistance	**Adaptive Cruise Control** **Stop &Go** **Lane Keeping Assist** **Lane Change Assist**		**C-ACC Truck Platoning**						
Level 0: No Driving Automation, support beyond human capability to act	**Lane Departure Warning** **Blind-spot Warning** **Forward Collission Warning** **ABS, ESC** **Emergency Brake**								

Indicative development paths TRL 7-9

Highway chauffeur, open roads

Unmanned vehicles, confined and hub-to-hub

Truck: Freight vehicle > 3.5 tonnes categorie N2 or N3

Automated Urban Mobility Vehicle Development Paths

Automation Level	Established	2018	2020	2022	2024	2026	2028	2030	...
Level 5: Full Automation								**Fully automated Urban Mobility Vehicles**	
Level 4: High Automation			**Automated PRT/Shuttles on Dedicated Roads**; **Automated PRT/Shuttles in Mixed Traffic**; **Automated Buses on Dedicated Roads**; **Automated Buses in Mixed Traffic**						
Level 3: Conditional Automation			**Automated Urban Bus Chaffeur**						
Level 2: Partial Automation				**Urban Bus Assist**; **Traffic Jam Assist**; **Parking Assist**					
Level 1: Driver Assistance	**Adaptive Cruise Control**; **Stop &Go**; **Lane Keeping Assist**; **Lane Change Assist**; **Parking assist**								
Level 0: No Driving Automation, support beyond human capability to act	**Lane Departure Warning**; **Blind-spot Warning**; **Forward Collission Warning**; **ABS, ESC**; **Emergency Brake**								

Indicative development paths TRL 7-9

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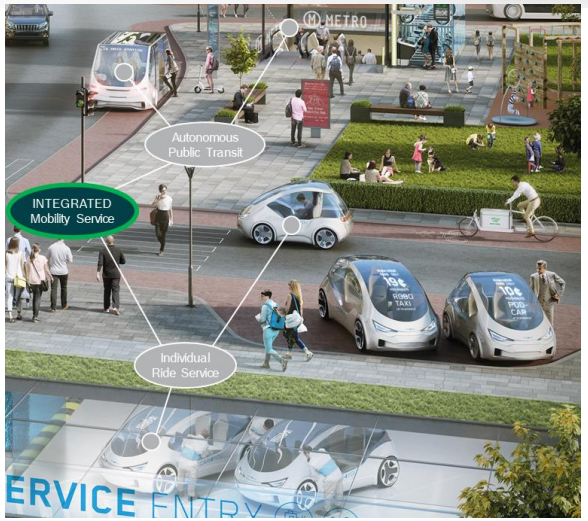


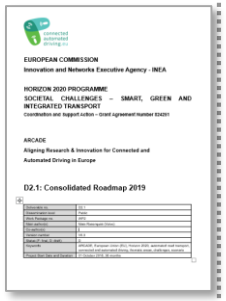
PRT (Personal Rapid Transit) incl. Urban Shuttle
City Bus/Coach: M2 < 5 tonnes < M3

Consolidated Key Priorities per Use-Case vs Thematic area

		D3.7 Society Challenges & Scenarios				D3.4 Systems and Services Challenges & Scenarios			D3.1 Technical Challenges & Scenarios			
		User awareness, users and societal acceptance and ethics, driver training	Safety validation and roadworthiness testing	Policy and regulatory needs, European harmonisation	Socio-economic assessment and sustainability	New mobility services, shared economy and business models	Big data, artificial intelligence and their applications	Digital and physical infrastructure	Human Factors	Connectivity	Deployment	In -vehicle technology enablers
Development Paths / Use Cases	Generic	Societal Needs Analysis from user and society perspectives	Alignment of vehicle regulation (and type approval) and corresponding assessment tools & procedures	Working for flexible AD regulation, enabling different solutions, within the boundaries of safety.	Impact assessment needs both pilots (low TRL) and FOTs (high TRL)	Foster the development of new ecosystems, new types of partnerships, new business models in the fields of services	Develop 'standard' model for sharing data that ensure data privacy and security	Define common EU standards for the interaction of PDI and AVs (e.g. ISAD, ODD)	Integrated Safety (passive, active, seating positions, crash impact, etc)	Definition of connectivity requirements for AD functions (performance, QoS, resilience, etc.)	Living labs to support tests and demonstration by including end users earlier	Harmonize definition of ODDs and functionalities needed for given ODDs
		Positive Risk analysis	Determine proper combinations of virtual testing, closed test track and open road testing of AVs	Learn from adaptation of regulation, work towards common approach	Development of EU-level databases to allow more reliable scaling up (data on accidents, mileage, etc. including ODD aspects, with sufficient details and granularity)	Pilots and FOTs to validate business case, operational models and specifications	Harmonisation, alignment needed for development and validation of AI functionalities for AV	Define Classifications of PDI	Interaction with external road users (mixed traffic)	Specification of Day 2 and Day 3 C-ITS services	L4 Pilots including cross-border applications	Define, develop, and validate robust and scalable perception systems and sensor sets
		Ethics evaluation based on technology understanding	Share and harmonise driving/traffic scenarios and best practices	Build common CAD framework	Development of commonly available (validated) AV simulation and other evaluation tools	Define the involvement of public authorities in the early stage of deployment to create trust among stakeholders	Standards and solutions (HW/SW) for data management and data quality (e.g. L3Pilot)	AV-ready road planning and self-explaining roads. (e.g traffic signs and lane marking for Avs)	New role of remote operators (sustain attention, control environments, etc)	Standardisation and further deployment of V2X technologies	L3 FOT including cross-border applications	Develop technologies supporting vehicle's own understanding of ODDs and cooperation between AD vehicles. (incl. maps, localization,..)
		Impact on driver/users and operator training	Consensus building with respect to validation of methodologies, including Data-labeling standards	Make cross-border testing easy	Commitment to use common impact assessment methodologies (like FESTA, Trilateral framework)	Integration of new services with existing services (e.g. public transport) from start	Develop new AI-concepts for cyber-physical road traffic systems	Investigate the use of common definitions (e.g. ISAD). Create Living lab with PDI	Behavioral change. Social inclusion	(Cyber)secure and safe communications respecting privacy and various levels of trust	Promote deployment through simulations of scenarios, road transport & traffic management	Maintain system integrity and well-functioning once in the field, monitor for updates
		Secure privacy for mobility users	Develop procedures to manage validation of vehicle updates monitoring during the whole lifecycle of the vehicle	Harmonisation of the interpretation of traffic rules, digitalization of traffic sign information	Research on the long-term indirect impacts of automation, equity etc.	Further develop urban delivery AD solutions	Harmonisation of AI investments development	Define the involvement of public authorities in the early stage of deployment to create trust among stakeholders	Learning, education	Interoperability of communication technologies / Hybrid connectivity solutions	Customer pilots with non-homologated vehicles	Reach efficient integration of overall system in fail-operational architectures (costs, energy, redundancy)
	Passenger Cars	(no specific)	Homologation framework and simulations, self-certification	(no specific)	Impacts on safety and travel behaviour	Peer-to-peer sharing	New robust AI-passenger-car solutions	(no specific)	(no specific)	(no specific)	(no specific)	(no specific)
	Freight Vehicles	New fleet operation schemes for AV	Homologation framework Hub-to-hub, semi-confined ODDs	Business case for platooning need to be clarified depending on regulation scenario	Impacts on transport network efficiency and environment	Logistics services Business need for AD (TCO)	New AI freight and logistics solutions	Hub-to-hub corridors Freight traffic management. Truck parking safe-zones for AD trucks	The role of professional truck drivers	Correctness and latency for multi-brand configuration	Commercial operational pilots	Superstructure, e.g. trailer)
	Urban Mobility Vehicles	City authority Perspectives	VRU scenarios for unmanned buses and shuttles	Support early introduction through exemptions	Impacts on transport mode choice and social inclusion	New infrastructure business models and financing tools	New AI urban mobility solutions	Traffic management complementing public transport	The role of professional bus drivers	Specific requirements for remote operation "control-tower"	Identify needs.	Low-speed, low-tech AVs

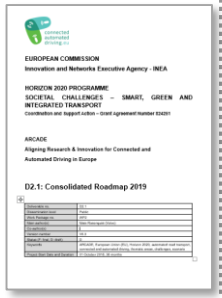
ARCADE Consolidated roadmap evolution and main results

EUCAD2019

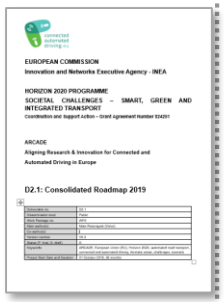


Joint stakeholder workshop

EUCAD Symposium, TRA



EUCAD2021



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ARCADE Consolidated Roadmap 2020

ARCADE Consolidated Roadmap 2021

Year 1

Year 2

Year3

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