HADRIAN

Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs

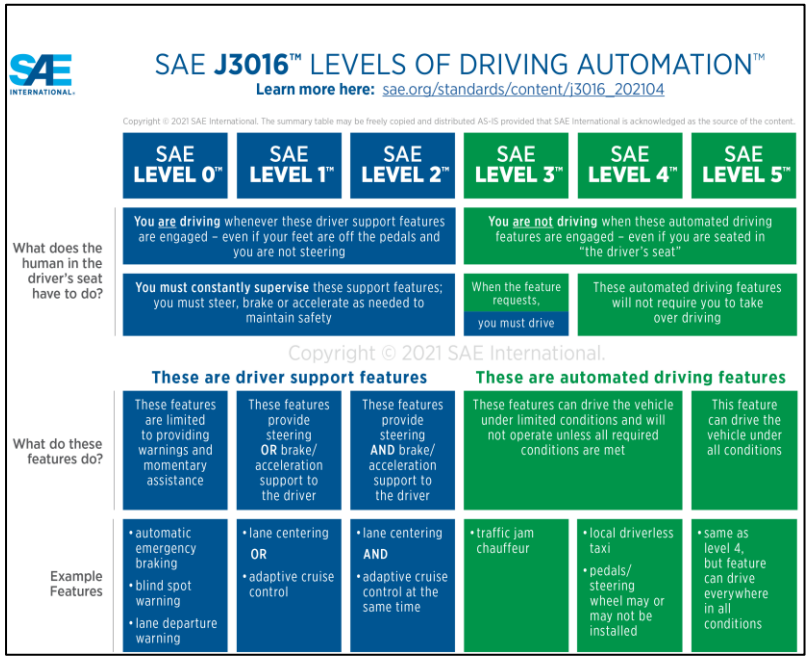
An Overview

May 9th, 2023

www.hadrianproject.eu/

HADRIAN has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875597.

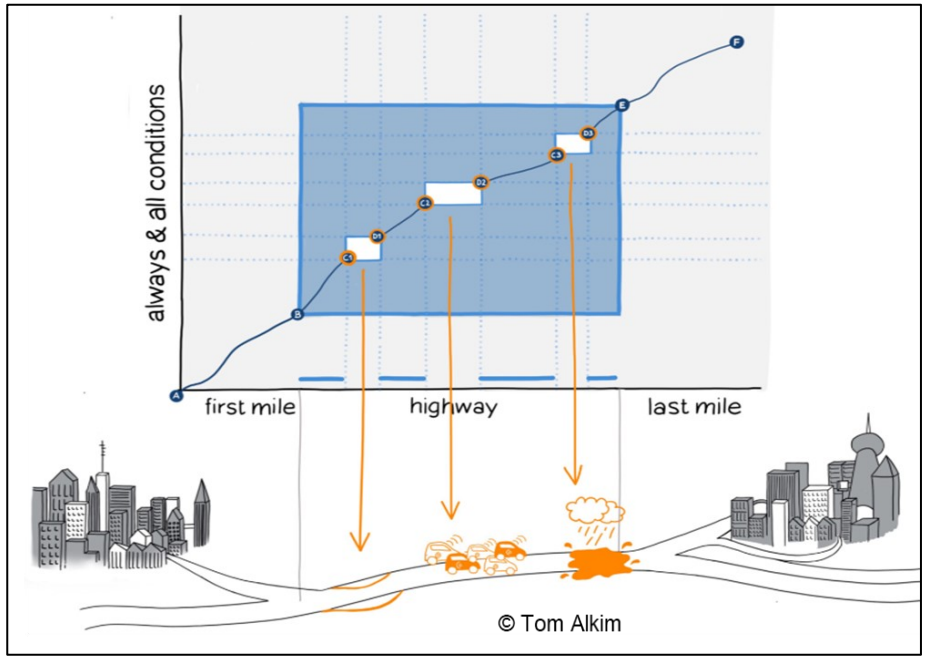
MOTIVATION



SAE J3016™ LEVELS OF DRIVING AUTOMATION™

Learn more here: sae.org/standards/content/j3016_202104

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	**You are driving** whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			**You are not driving** when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			**These are automated driving features**		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering **OR** brake/ acceleration support to the driver	These features provide steering **AND** brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering **OR** • adaptive cruise control	• lane centering **AND** • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/ steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions



Develop solutions for drivers to safely, comfortably, and acceptably use driving automation to meet their mobility needs

AUTOMATED DRIVING WITHIN EU MOBILITY DEVELOPMENTS

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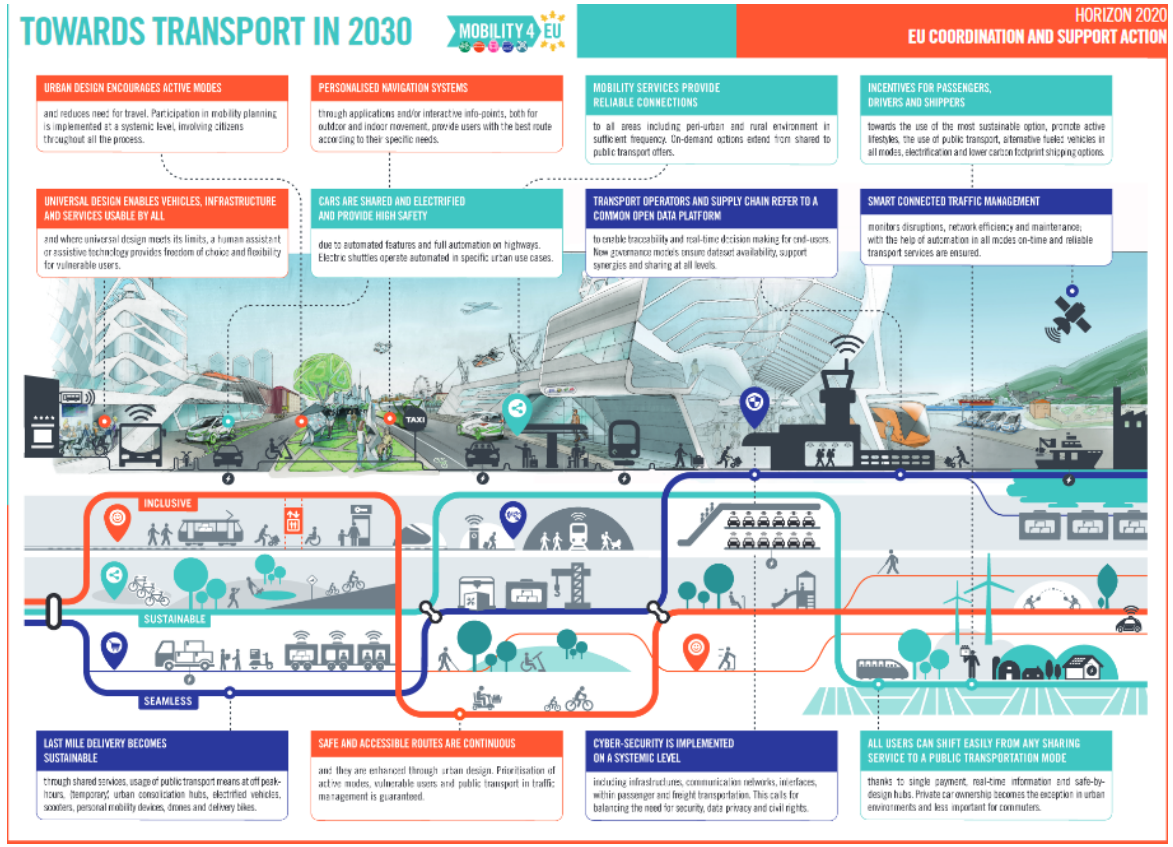

https://www.mobility4eu.eu/?wpdmdl=2160

From European Mobility Visions for automated driving..

.. to concrete applications
to meet people‘s mobility needs:
3 personas in
12 mobility scenarios

AD MODES AND IDENTIFIED SOLUTIONS

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1 Perception Assistant for manual and automated driving

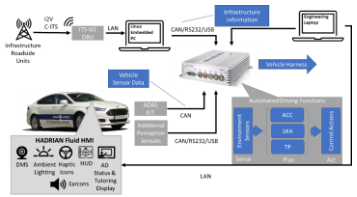
2 Enhanced conditional (Level 2) Automated Driving

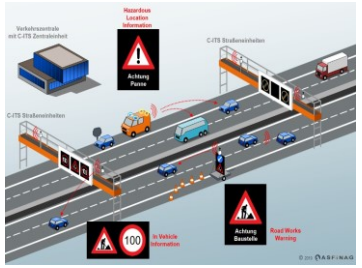
3 Enhanced partial (Level 3) Automated Driving

4 Enhanced partial (Level 4) Automated Driving

5 Guarding Angel for manual driving

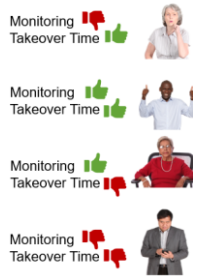
Enhanced Predictability through Integration with Road Infrastructure

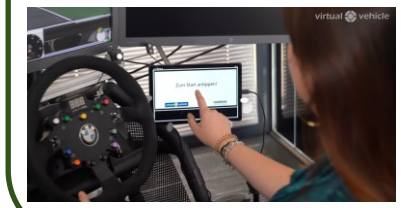




Fluid Human Machine Interactions with Driver Monitoring

Driver Tutoring to enhance AD competences





HADRIAN RESEARCH IN A NUTSHELL

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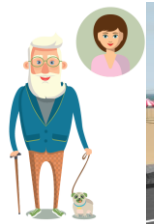
- Designed a standardized set of driving simulators for researchers for all partners (SCANer Studio)
- Consortium performed 22 empirical studies in driving simulators across Europe and Turkey
  - With overall 863 human participants
    - Driver monitoring systems (235 participants)
    - Initial design iterations of fluid HMI (419 participants)
    - Final evalutions of fluid HMI (209 participants)
- Also field study on Level 3 NDRA and take-over












HADRIAN DEMONSTRATIONS

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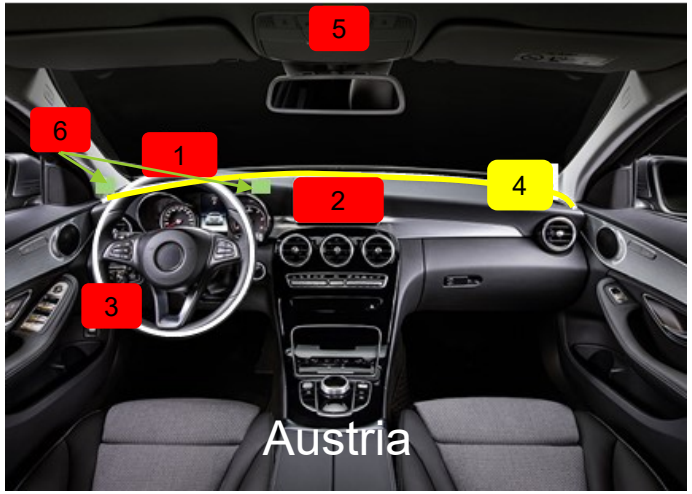
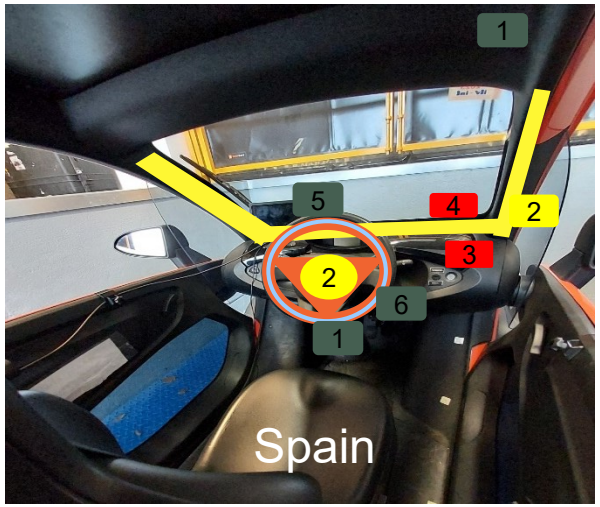
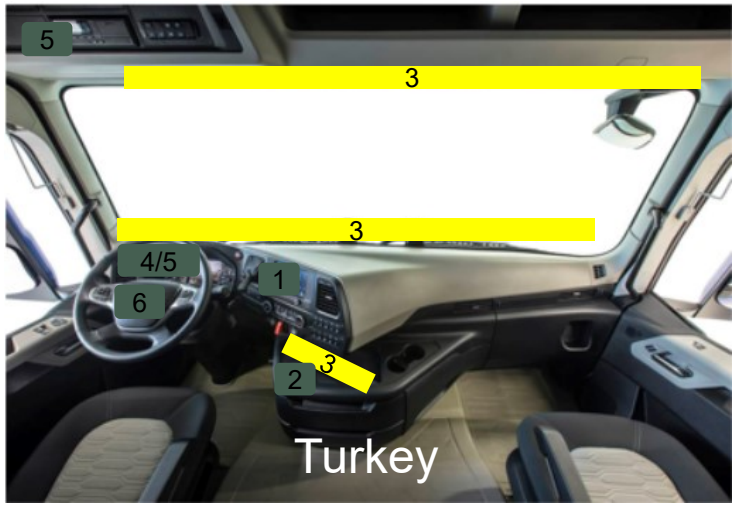
Demonstrated HADRIAN innovations with 32 participants on test tracks and open road environment



- HUD displays time critical information for transition:
- HADRIAN AD predictability and tutoring on a tablet
- Steering wheel feedback
- Ambient lighting
- Hands-on-wheel DMS camera
- Eye-gaze DMS cameras
- Auditory cues



- Hands-on-wheel DMS camera
- Ambient lighting
- HADRIAN AD Display
- Auditory cues
- HUD
- Haptic steering wheel



- Human-Centered f-HMI
- Auditory Cues
- Ambient lighting
- Truck Driver Monitoring System
- Basic Fit2drive App
- Steering wheel feedback

HADRIAN KEY RESULTS

- Demonstrated user benefit of enhancing automated vehicle functionality with road infrastructure information
  - Expanded vehicle time horizon from 5 to 15 sec
  - Provided predictable AD availability for increased user benefit
  - Demonstrated increased continuity of ADL 3
- Identified multi-modal fluid HCI solutions in the vehicles to increase AD safety and comfort
  - Engaged transfer to standardization via ISO
  - Tested fluid driver feedback as important method to increase driver competences and trust
- Developed and applied advanced safety analysis methods for AD benefits
  - Data Envelopment Analysis (DEA)
  - Human reliability estimation methods
- Implemented and tested improved AD control algorithms and corresponding HCI in commercially available vehicles on the road
- Documented HADRIAN innovations in 55 publications

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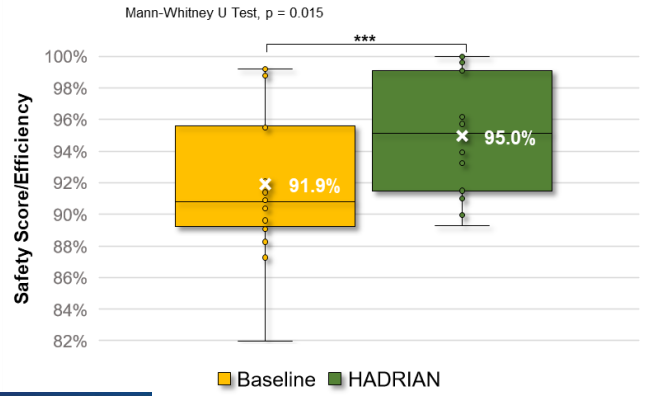
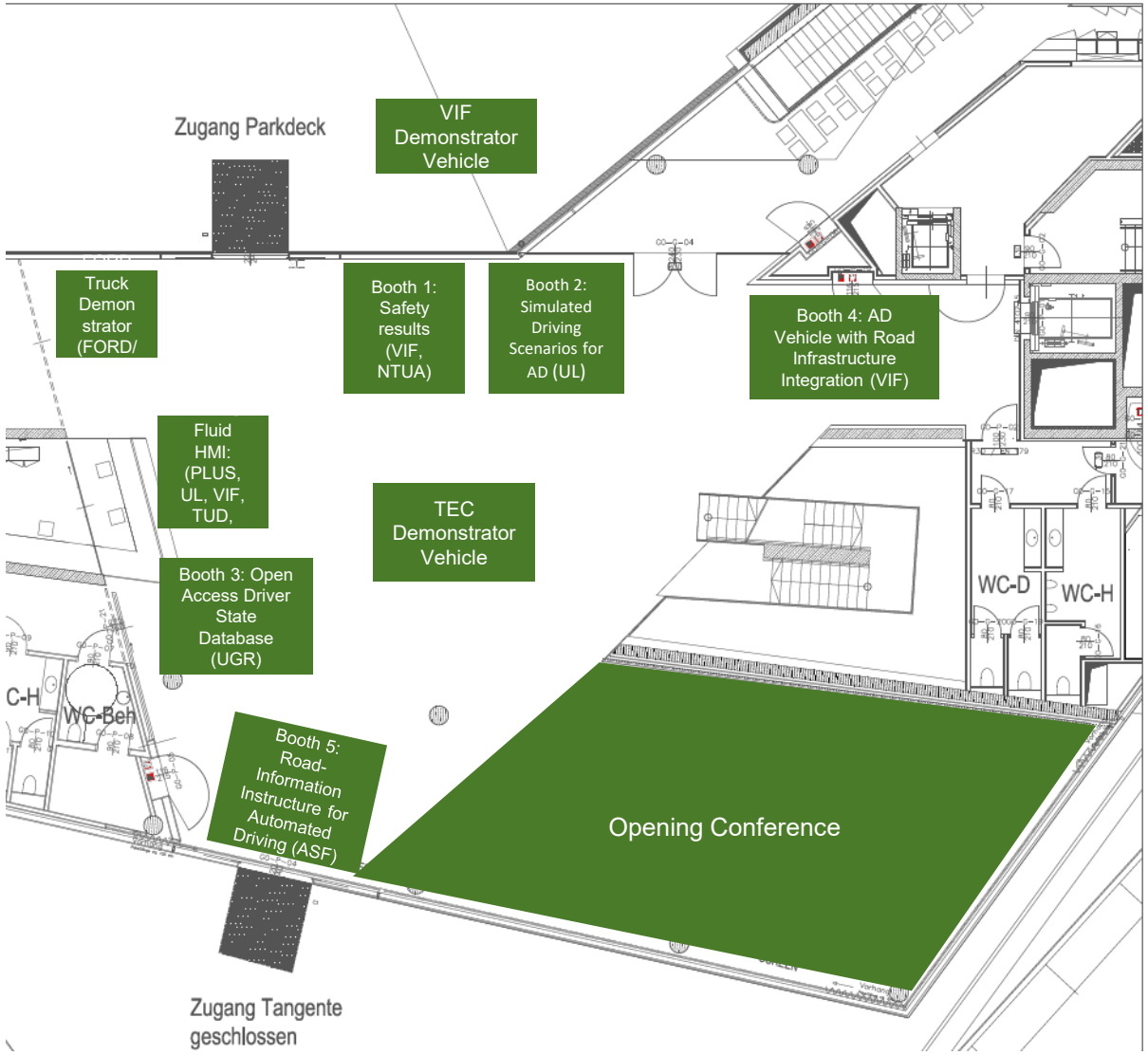
Safety Scoring using DEA



KEY RESULTS

- Safety results: booth 1
- Driving simulator methodology for AD: booth 2
- Open access annotated database for driver state monitoring: booth 3
- AD vehicle – road infrastructure integration for increased AD predictability and availability: booth 4
- Road infrastructure information for AD: booth 5
- Fluid Human Machine Interaction: booth 6
- TEC demonstrator: guardian angel and haptic icons
- Ford Truck demonstrator
- VIF Demonstrator (outside)



HOLISTIC HADRIAN DEMONSTRATION VEHICLE

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- If you are interested in experiencing the holistic HADRIAN demonstration vehicle, please register at the reception
  - A few slots are still available
- Next
  - Please visit the information booths and demonstrators
  - At 12:30: lunch
  - At 13:45 group foto in main exhibition hall
  - At 14:00 working session 1: HADRIAN HCI Innovations

CONSORTIUM

- Human centred design for the new driver role in highly automated vehicles
- **Coordinator**: VIF
- **Duration**: 42 Months
- **Start**: Dec 2019
- **Funding**: 8 Mio EUR

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virtual vehicle

National Technical University of Athens

University of Ljubljana

tecnalia Inspiring Business

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ASFINAG

UNIVERSITÄT SALZBURG

bast

IESTA

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FROM RESEARCH TO INDUSTRY ceatech