STAPLE
SiTe Automation Practical Learning

CEDR Call 2017 Automation - Final Conference

6th November 2020

http://www.stapleproject.eu/

General information about STAPLE

STAPLE - SiTe Automation Practical Learning

- Call – Practical learnings for NRA's from test sites (2017 CEDR Call "Automation")
- Duration: 1 September 2018 – 31 August 2020
- Consortium
  - ❑ FEHRL (Project Coordinator)
  - ❑ AIT, Austria
  - ❑ ERICA, Poland
  - ❑ Université Gustave Eiffel, France
  - ❑ MAPLE Consulting, UK
  - ❑ VTI, Sweden

Objectives (1/2)

The objectives of STAPLE are to:

- Provide an overview of test sites in Europe and beyond;
- Provide a catalogue of these sites and detail how they contribute to NRA priorities;
- Undertake a detailed investigation into a selected number of test sites including visiting a selection of sites;

Objectives (2/2)

The objectives of STAPLE are to:

- Assess the implications of the findings of the test sites for future NRA options;
- Analyse and report on the practical learnings from test sites worldwide, including gaps where NRA needs are not addressed;
- Provide a report and recommendations for future research and test site focus.

Methodology

Phase I

Overview of test sites in Europe, USA, Asia, rest of world

Catalogue of sites detailing:
- Focus area of each test site
- How they contribute to / investigate:
  - Road safety
  - Traffic efficiency
  - Customer service
  - Maintenance
  - Construction
  - Other

Phase II

Workshop to determine areas of greatest NRA interest / importance

Detailed investigation:
- Interviews with test site leads – on-line / phone
- Visit certain test sites

Phase III

Assess implications for
- Level 3 and level 4 systems in a safe way
- Roads with and without physical infrastructure
- Maintainability and construction
- Roadside equipment of today and tomorrow

Analysis:
- Practical learnings from test sites
- Roles and responsibilities of the different stakeholders
- Impact and socio-economic assessment of different tests sites
- Test site assessment of impact of NRA core business and functions including maintenance

Phase IV

Workshop to present outline results of test sites and identify gaps

Report and recommendations for future research and test site focus

Work Packages

WP1 – Project Management

WP2 – Overview of connected and automated driving test sites → **Phase I (Sep 2018 – Feb 2019)**

WP3 – Test sites data collection → **Phase II (Dec 2018 – Sep 2019)**

WP4 – Analysis and impact assessment of test sites → **Phase III (July 2019 – March 2020)**

WP5 – Reporting and Recommendations → **Phase IV (Feb 2020 – Aug 2020)**

WP6 – Dissemination

Phase I

Purpose:

Establish a broad overview of the existing connected and automated test sites

Process:

First data collection and criteria

Catalogue compilation

Initial assessment and pre-selection

Outcome:

The search yielded over 70 test sites and test beds in 20 countries

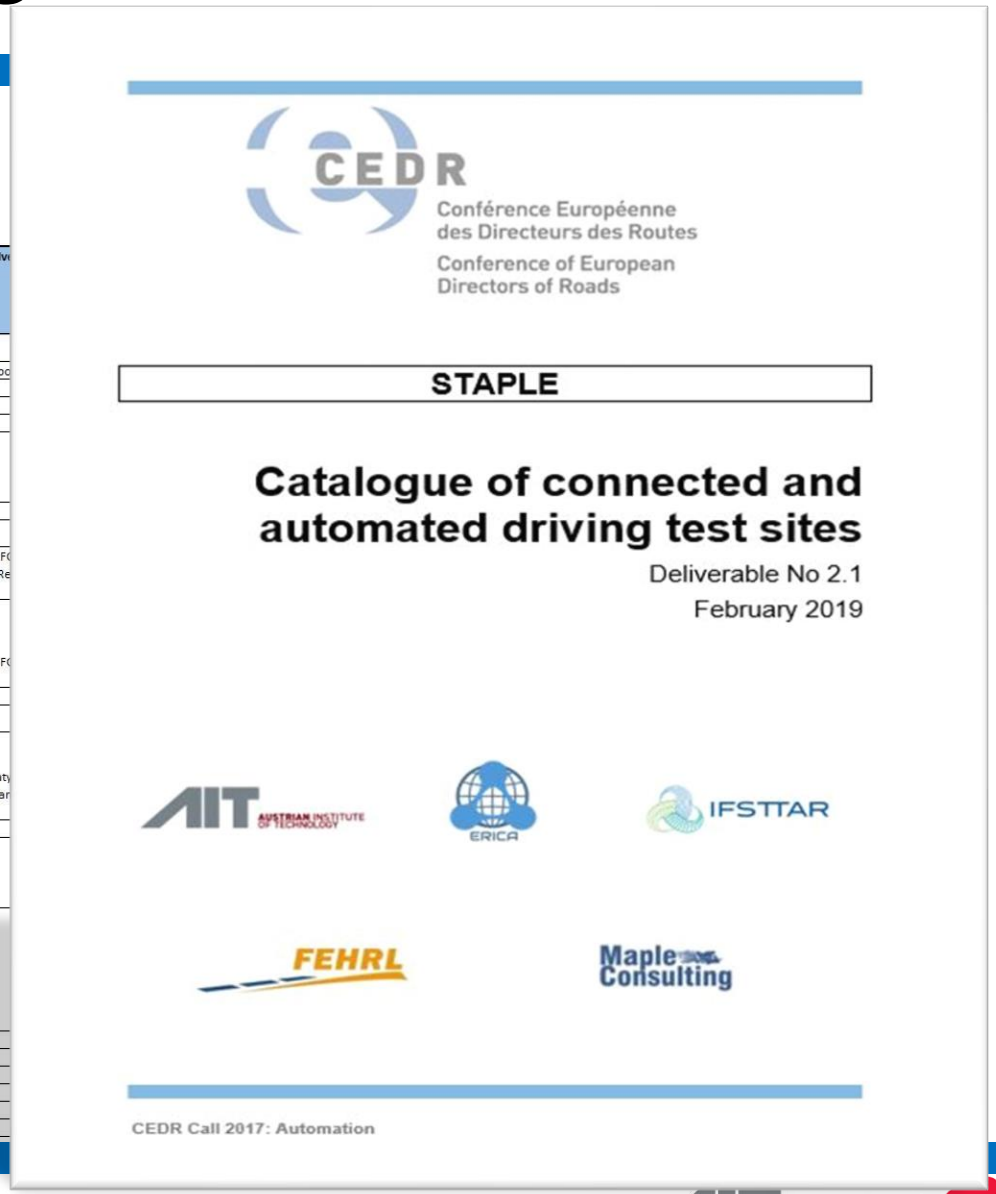
Across Europe and beyond

Outputs

STAPLE

- Searchable Catalogue

Short name	Name of Test site/Test bed	Location	Public/Private/PPT - joint (NRA involv
GERMANY			
Digital Test Bed A9	Digital Test Bed A9	Munich- Ingoslstadt	Public- Federal Ministry of Transpo
test Autonomous Driving Baden-Württemberg (TAF BW)		Karlsruhe,	
Cross-border Digital Test Bed	French-German-Luxembourgish cross-border Digital Test Bed.	Merzig, Sarrebruck, Metz et Luxembourg	
Aldenhoven Testing Center	Aldenhoven Testing Center	Aldenhoven,Germany	
Dusseldorf Test Track	Dusseldorf Test Track	Dusseldorf	PPT
AUSTRIA			
AlpLab	Austrian Light Vehicle Proving Region for Automation Driving	near Graz, Austria	PPT-joint (Ministry of Transport, FF Graz, Virtual Vehicle, Joanneum Re a setup partner
DigiTrans	DigiTrans Test Region for automated driving with focus on freight mobiity and logistics aspects	Upper Austria, Austria	PPT-joint (Ministry of Transport, FF supporter per LOI)
United Kingdom			
A2M2 Connected Corridor	A2M2 Connected Corridor	London / Kent UK	PPT-Highways England, Kent County for London, UK Department for Trar ERTICO
Smart Mobility Living Lab	Smart Mobility Living Lab	London	PPT
UK Autodrive	UK Autodrive	Milton Keynes and Coventry	Public
UK CITE	UK CITE	West Midlands	Public
Midlands Future Mobility	Midlands Future Mobility	West Midlands	PPT
Millbrook-Culham Test and Evaluation Environment	MCTEE	Oxfordshire / West Midlans	PPT
Horiba MIRA	TIC-IT	West Midlands	Private
Project CAV Forth	Project CAV Forth	Edinburgh	PPT
Project Apollo	Projec Apollo	Greenwich, London	PPT
ServCity	ServCity	Conventry / London	PPT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Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

STAPLE

Catalogue of connected and automated driving test sites

Deliverable No 2.1
February 2019

CEDR Call 2017: Automation

Phase II – test site data collection

Identify key areas relevant to the core business of NRAs

Collect appropriate performance data from the test sites

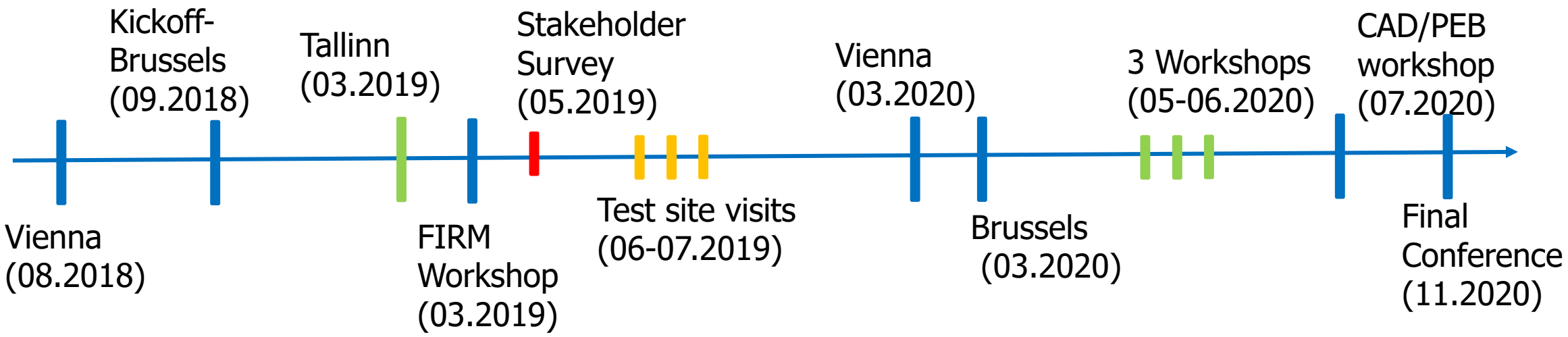
Workshop to obtain stakeholders view on test sites selection and specific performance areas important for NRAs' core business

Based on NRA's input and interest, visits to 2 – 3 European test sites will be organised

Stakeholders' Consultations

- STAPLE participated in CAD/PEB workshops/conferences: Vienna (08.2018), Kickoff (09.2018), Tallinn (03.2019), Brussels-FIRM (03.2019), Vienna (03.2020), Brussels-FIRM (03.2020)
- Meetings with PO: quarterly and as needed meetings with project officers
- Test site visits with PEB invited: June-July 2019
- Staple workshops: 3 workshops with PEB/CAD members: 05.2020
- Cancelled due to COVID-19: TRA 2020 (invited session and paper podium presentation)
- Instead 4 workshops online
- Newsletters, website: bi-annual project info dissemination
- Stakeholders survey 05.2019

Stakeholders' Consultations



Phase II Overview

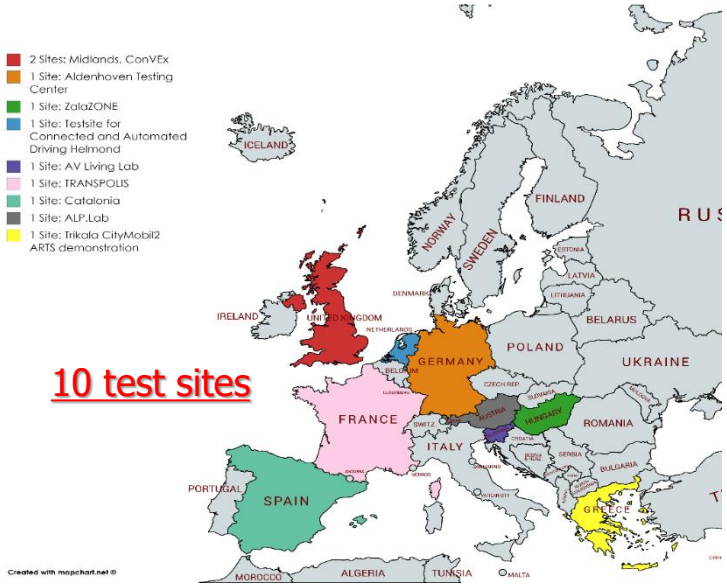
- Summary of Findings from Stakeholders' Survey
  - ***Electronic survey of 11 questions sent to all test site operators (72 test sites)***

most use cases covered, various speeds, human in the loop, physical infrastructure testing and cybersecurity

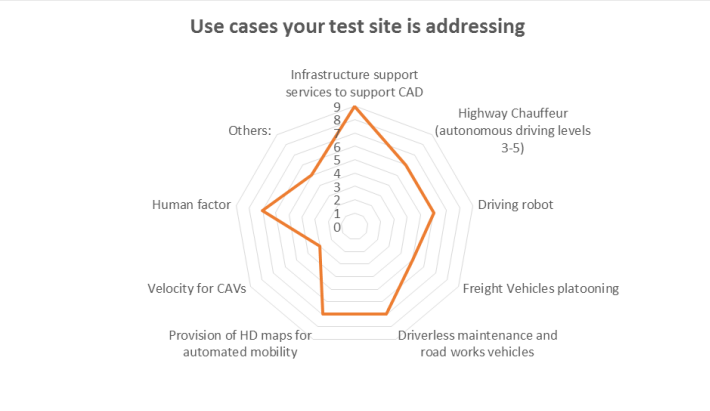
moving traffic, congested traffic and incidents, trip optimization based on the real time demand, impacts of different penetration rates, automated vehicle platoons, fuel saving and effects in mixed traffic situation.

perception of CAVs, privacy and data protection, considering social inclusion, facial recognition as a payment model,

passive, active, interactive and connected roadworks warnings, real time data collection by maintenance vehicles, using robots for road works



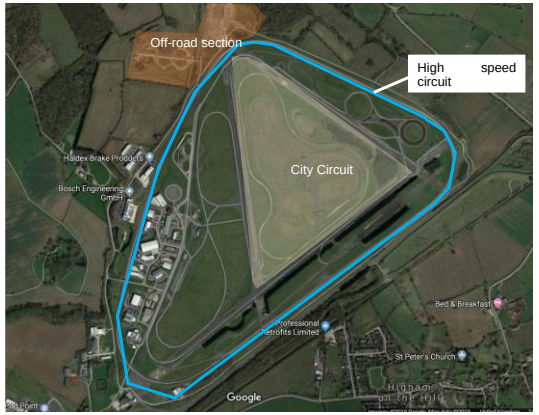
10 test sites

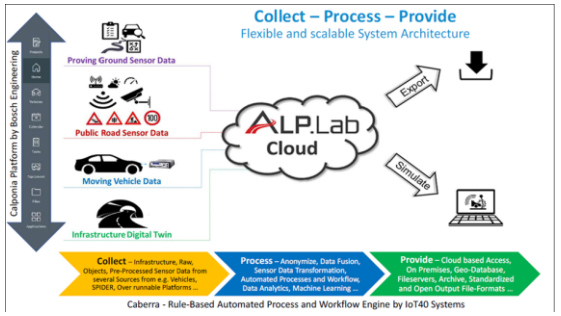


Phase II Overview

- Summary of Findings: Test site Visits & Interviews

  - ***Test sites in the UK**: Horiba MIRA (priority areas of **RS, TE, CS**) and Midlands Future Mobility (priority areas of **RS, TE, CS, CM**); June 2019*
  - ***Test site in Austria**: ALP.Lab (priority area of **RS**); July 2019*
  - ***Test site in France**: TRANSPOLIS (priority areas of **RS, TE, CS**); July 2019*





Phase III Overview

Purpose:

To carry out in-depth analysis of the collected data, provide practical learnings and an analysis of socio-economic impacts and impacts on NRA core businesses

Process:

Analyse data from WP2 and WP3

- Assessment of impacts of test sites
- Assessment of socio-economic aspects of test sites

Outcome:

Report on impacts and practical learnings from test sites

Use cases – socio-economic

Truck platooning (FR)

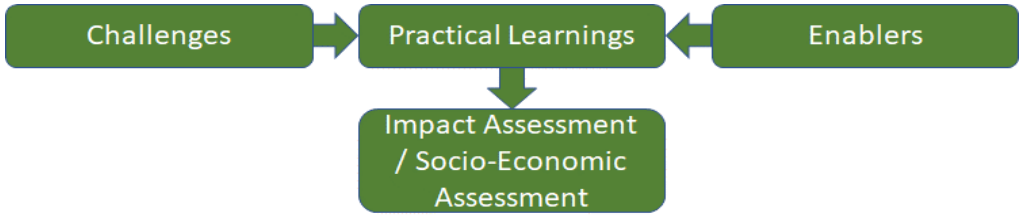
Cyber security and data case study (FR)

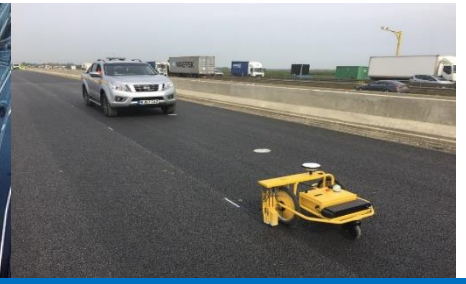
Self-driving vehicle cyber security testing capabilities (UK)

White line pre-marking robot (UK)

Phase III Overview

- Summary of Practical Learnings:
  - Clear benefits for NRAs (evaluation of CAVs-safety, testing various use cases, testing specific technology for comms/data sharing, pavement markings, maintain. robots).
  - NRAs to adapt their organisational and strategic work to fully realise potential of different test sites, e.g. roadmaps to make the right investment decisions, contractual agreements on data sharing, become a TS partner
  - Close cooperation between test sites, NRAs and manufacturers need to work together to optimize results of current research, explore synergies and to potentially co-fund research for shared benefits.





Project Outputs

Catalogue of connected and automated test sites

- Searchable database of sites in Europe and beyond for NRAs

Practical learnings from test sites

- Report on technological and non-technological aspects

NRA impact and socio-economic impact assessment

- How sites align to NRA business areas
- How humans interact with automated vehicles

Final recommendations for future test sites

- Report
- Practical guidance

Workshops

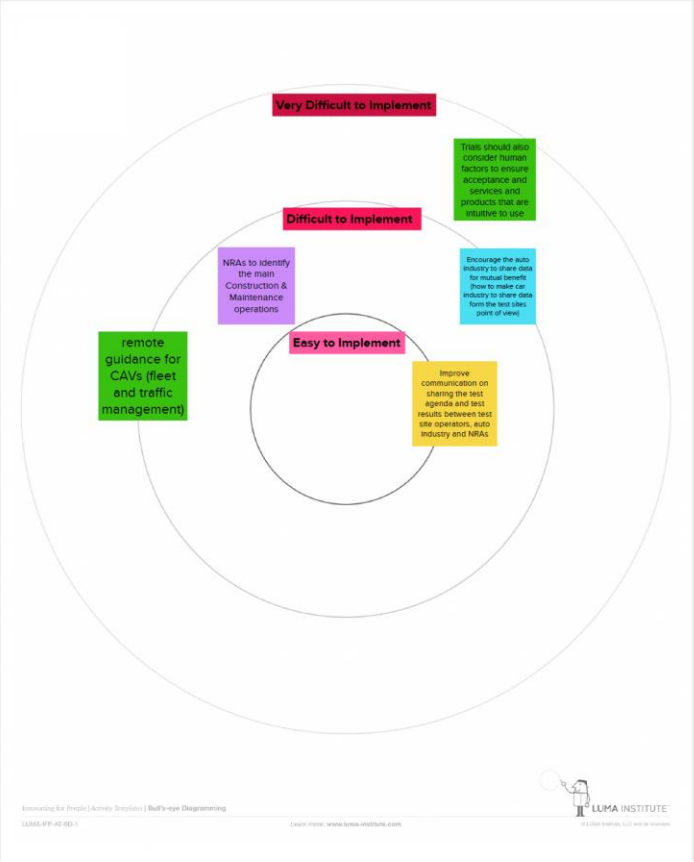
Workshop 1	Workshop 2	Workshop 3
Traficon, Finland	Trafikverket, Sweden	Highways England, UK-England
Université Gustaf Eifel / Transpolis, France	Highways England, UK-England	CEDEX, Spain
AlpLab, Austria	Asfinag, Austria	TRAFICOM, Finland
	BASt, Germany	Danish Road Directorate, Denmark
		ZAG, Slovenia
		Rijkswaterstaat, Netherlands

Workshop Format

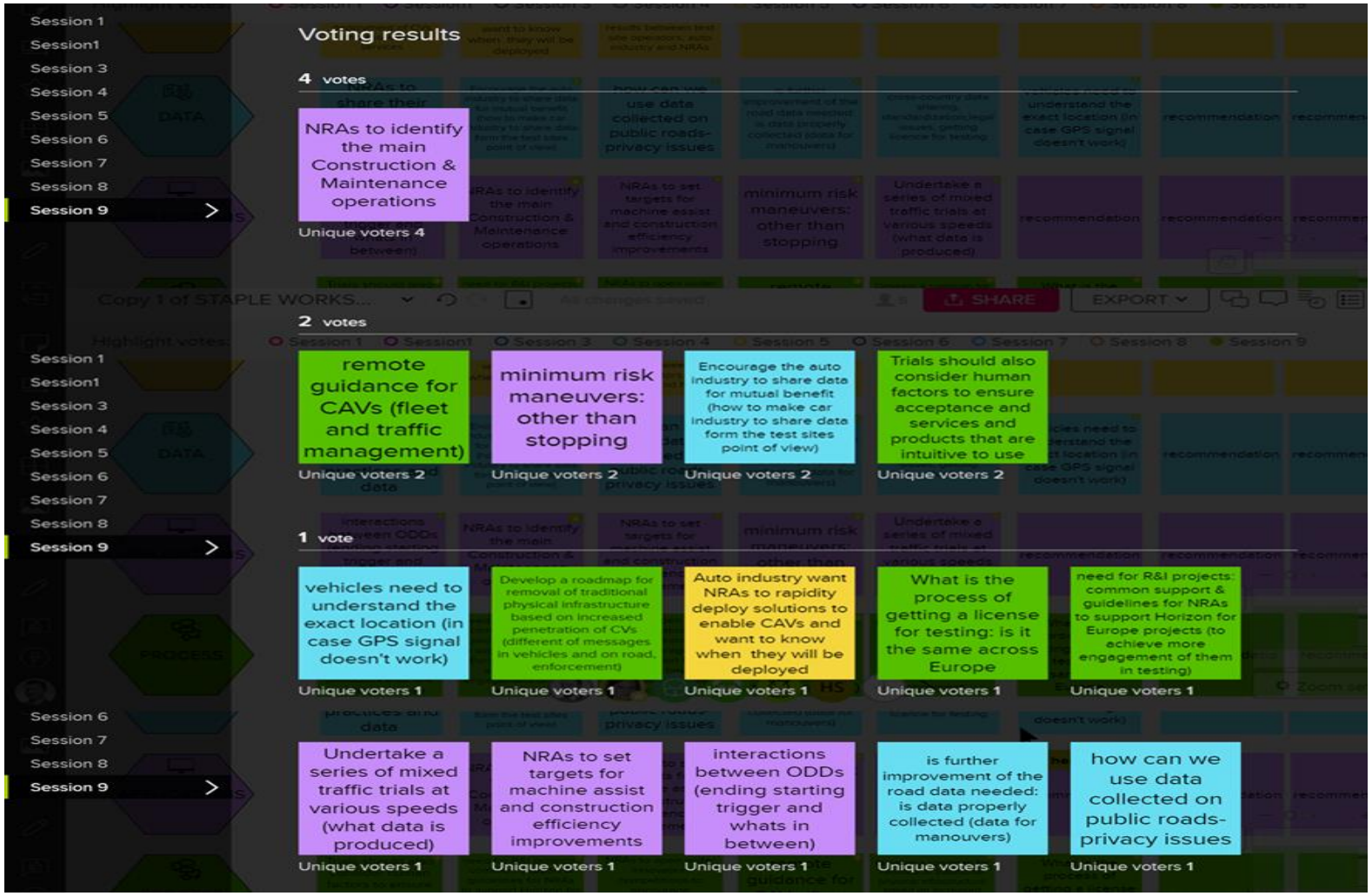
Recomendations

Determine easines of implementation

Categories	Recommendations							
COMMUNICATIONS	NRAs, test site operators and auto industry to work together to accelerate deployment of CVs and associated services	Auto industry want NRAs to rapidity deploy solutions to enable CAVs and want to know when they will be deployed		recommendation	recommendation	recommendation	recommendation	recommendation
DATA	NRAs to share their best practices and data		how can we use data collected on public roads-privacy issues	is further improvement of the road data needed: is data properly collected (data for manouvers)	cross-country data sharing, standardization,legal issues, getting licence for testing	vehicles need to understand the exact location (in case GPS signal doesn't work)	recommendation	recommendation
APPLICATIONS	interactions between ODDs (ending starting trigger and whats in between)		NRAs to set targets for machine assist and construction efficiency improvements	minimum risk maneuvers: other than stopping	Undertake a series of mixed traffic trials at various speeds (what data is produced)	recommendation	recommendation	recommendation
PROCESS		need for R&I projects: common support & guidelines for NRAs to support Horizon for Europe projects (to achieve more engagement of them in testing)	NRAs to open wider innovation competitions to encourage robotization from suppliers beyond their usual supply chain		Develop a roadmap for removal of traditional physical infrastructure based on increased penetration of CVs (different of messages in vehicles and on road, enforcement)	What is the process of getting a license for testing: is it the same across Europe	recommendatio	recommendatio



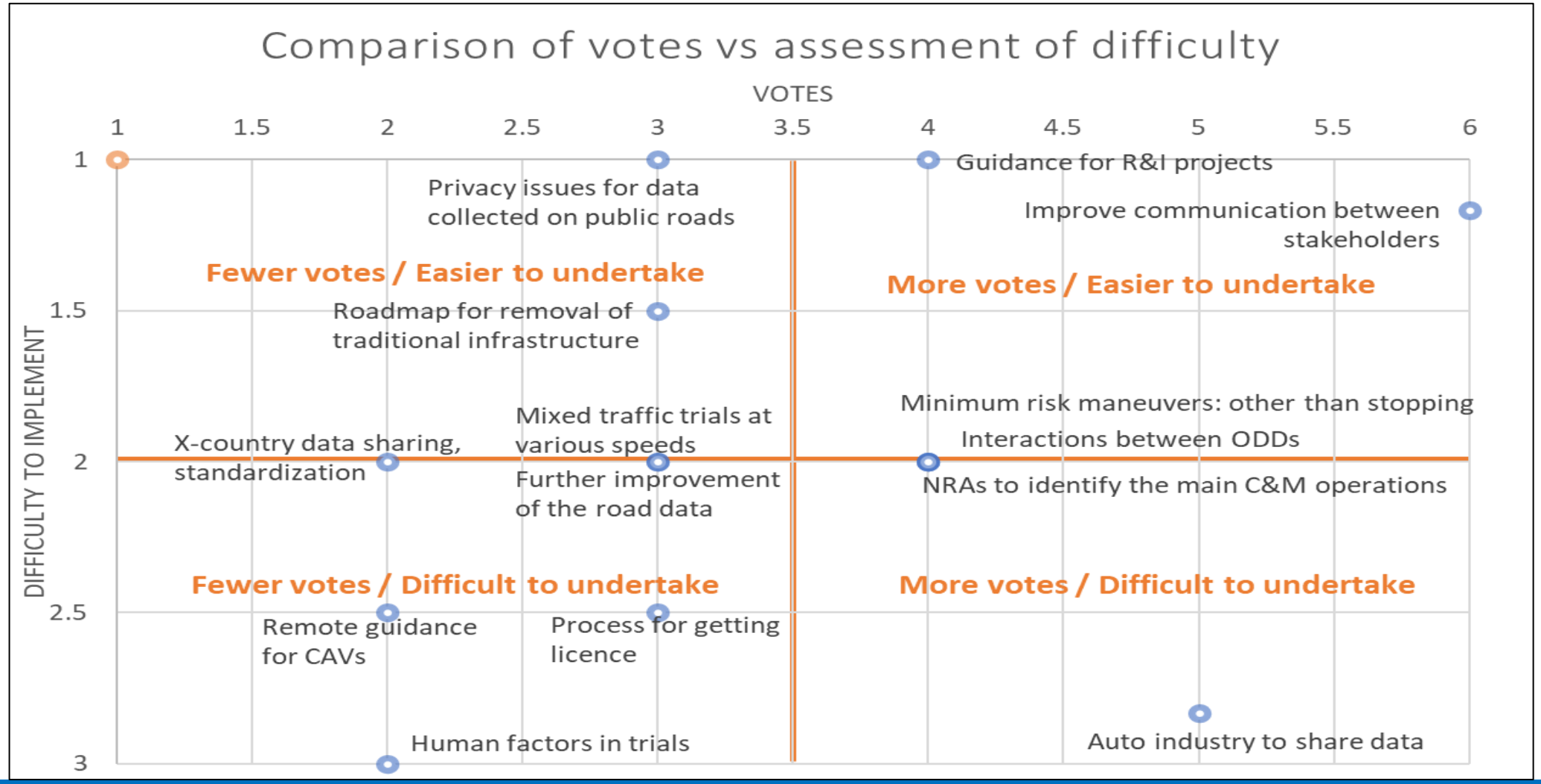
Voting


Voting results
4 votes
NRAs to identify the main Construction & Maintenance operations
Unique voters 4
2 votes
remote guidance for CAVs (fleet and traffic management)
Unique voters 2
minimum risk maneuvers: other than stopping
Unique voters 2
Encourage the auto industry to share data for mutual benefit (how to make car industry to share data form the test sites point of view)
Unique voters 2
Trials should also consider human factors to ensure acceptance and services and products that are intuitive to use
Unique voters 2
1 vote
vehicles need to understand the exact location (in case GPS signal doesn't work)
Unique voters 1
Develop a roadmap for removal of traditional physical infrastructure based on increased penetration of CVs (different of messages in vehicles and on road, enforcement)
Unique voters 1
Auto industry want NRAs to rapidity deploy solutions to enable CAVs and want to know when they will be deployed
Unique voters 1
What is the process of getting a license for testing: is it the same across Europe
Unique voters 1
need for R&I projects: common support & guidelines for NRAs to support Horizon for Europe projects (to achieve more engagement of them in testing)
Unique voters 1
Undertake a series of mixed traffic trials at various speeds (what data is produced)
Unique voters 1
NRAs to set targets for machine assist and construction efficiency improvements
Unique voters 1
interactions between ODDs (ending starting trigger and whats in between)
Unique voters 1
is further improvement of the road data needed: is data properly collected (data for manouvers)
Unique voters 1
how can we use data collected on public roads- privacy issues
Unique voters 1
Session 1
Session1
Session 3
Session 4
Session 5
Session 6
Session 7
Session 8
Session 9
SHARE
EXPORT

Highest Votes Received

Category	Subject	Votes
Communications	Improve communication between stakeholders	6
Data	Auto industry to share data	5
	Privacy issues for data collected on public roads	3
	Further improvement of the road data	3
	X-country data sharing, standardization	2
Applications	NRAs to identify the main Construction & Maintenance operations	4
	Interactions between ODDs	4
	Minimum risk manoeuvres: other than stopping	4
	Mixed traffic trials at various speeds	3
Process	Guidance for R&I projects	4
	Roadmap for removal of traditional infrastructure	3
	Process for getting licence	3
	Remote guidance for CAVs	2
	Human factors in trials	2

Votes vs implementation



Recommendations selected for expansion

Category	Subject	Votes
Communications	Improve communication between stakeholders	6
Data	Auto industry to share data	5
	Privacy issues for data collected on public roads	3
	Further improvement of the road data	3
	X-country data sharing, standardization	2
Applications	NRAs to identify the main Construction & Maintenance operations	4
	Interactions between ODDs	4
	Minimum risk manoeuvres: other than stopping	4
	Mixed traffic trials at various speeds	3
Process	Guidance for R&I projects	4
	Roadmap for removal of traditional infrastructure	3
	Process for getting licence	3
	Remote guidance for CAVs	2
	Human factors in trials	2

Recommendations selected for expansion

Category	Subject	Votes
Communications	**Improve communication between stakeholders**	**6**
Data	**Auto industry to share data**	**5**
	Privacy issues for data collected on public roads	3
	Further improvement of the road data	3
	X-country data sharing, standardization	2
Applications	**NRAs to identify the main Construction & Maintenance operations**	**4**
	Interactions between ODDs	**4**
	Minimum risk manoeuvres: other than stopping	4
	Mixed traffic trials at various speeds	3
Process	**Guidance for R&I projects**	**4**
	Roadmap for removal of traditional infrastructure	3
	Process for getting licence	3
	Remote guidance for CAVs	2
	Human factors in trials	2

Template for expanded recommendation

Recommendation			
Name of recommendation			
Votes Received		Ease of implementation	Easy / Medium / Hard
Benefits of implementation			
What benefits to NRAs / society / workers / safety…..			
Route to implementation			
Activities to be undertaken to implement it			
Timeline for implementation			
An idea of timeframe or sequence as above			
Barriers to implementation			
Technology barriers, unions, resistance to change….			

Filled Example

Recommendation	Votes Received
Support and provide guidelines for NRAs to encourage their participation in Horizon Europe projects	4

Votes Received	4	Ease of implementation	Easy

Benefits of implementation

The need for Research and Innovation projects in this area is clear and some NRAs expressed an interest in getting more involved with Horizon Europe and other research projects to achieve more engagement of the EC for CAV testing.

The benefits to NRAs would be clear procedures for engaging with, procuring and cooperating in larger scale, pan-European Research and Innovation Projects

Route to implementation

Engage with NRAs to understand their research priorities and map against stated research objectives of the EC in the Horizon Europe framework. provide a research roadmap for CEDR. CEDR and individual NRAs to meet and discuss their research objectives and potential cooperation.

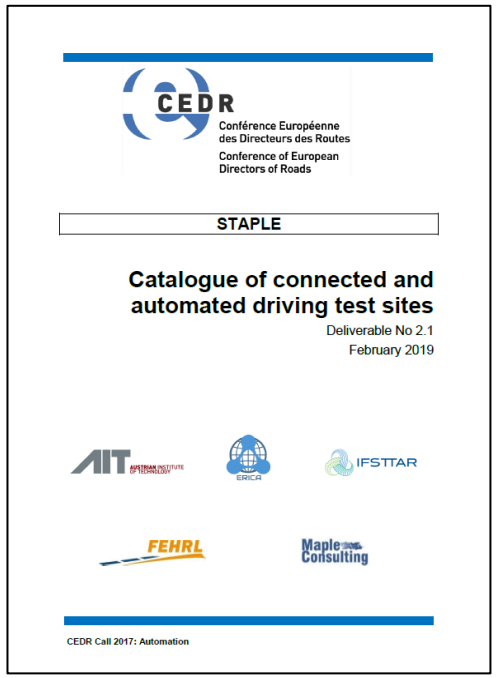
Timeline for implementation

This can be undertaken as a short-term operation, with a 6 month data gathering and research mapping project, followed by discussions.

Barriers to implementation

No specific barriers other than the fact that the EC have their own objectives for Research and Innovation which can be planned out several years in advance.

Outputs 1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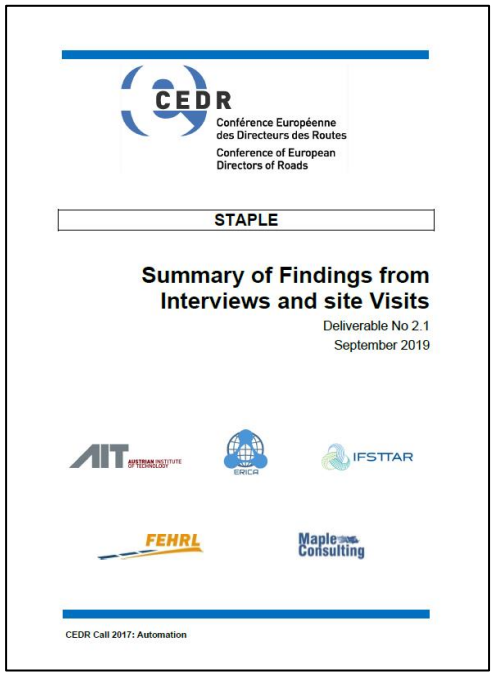
STAPLE

Catalogue of connected and automated driving test sites

Deliverable No 2.1
February 2019

CEDR Call 2017: Automation

D2.1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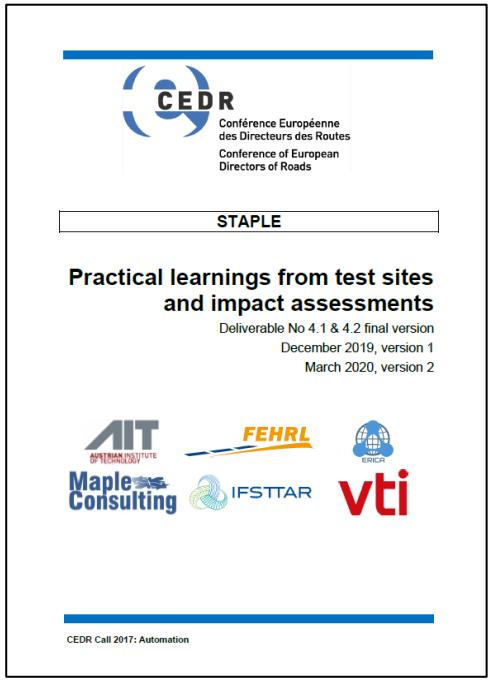
Summary of Findings from Interviews and site Visits

Deliverable No 2.1
September 2019

CEDR Call 2017: Automation

D3.1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STAPLE

Practical learnings from test sites and impact assessments

Deliverable No 4.1 & 4.2 final version
December 2019, version 1
March 2020, version 2

CEDR Call 2017: Automation

D4.1 / 4.2


CEDR
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Conference of European Directors of Roads

STAPLE

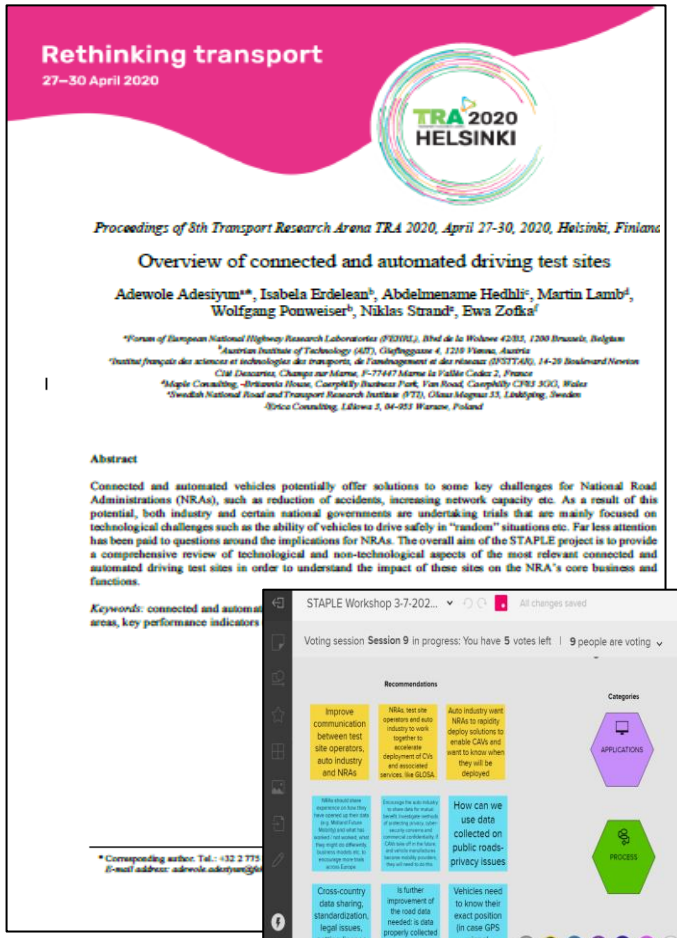
Recommendations for future test sites

Deliverable No 5.1
August 2020

CEDR Call 2017: Automation

D5.1

Outputs 2


Rethinking transport
27–30 April 2020

TRA 2020 HELSINKI

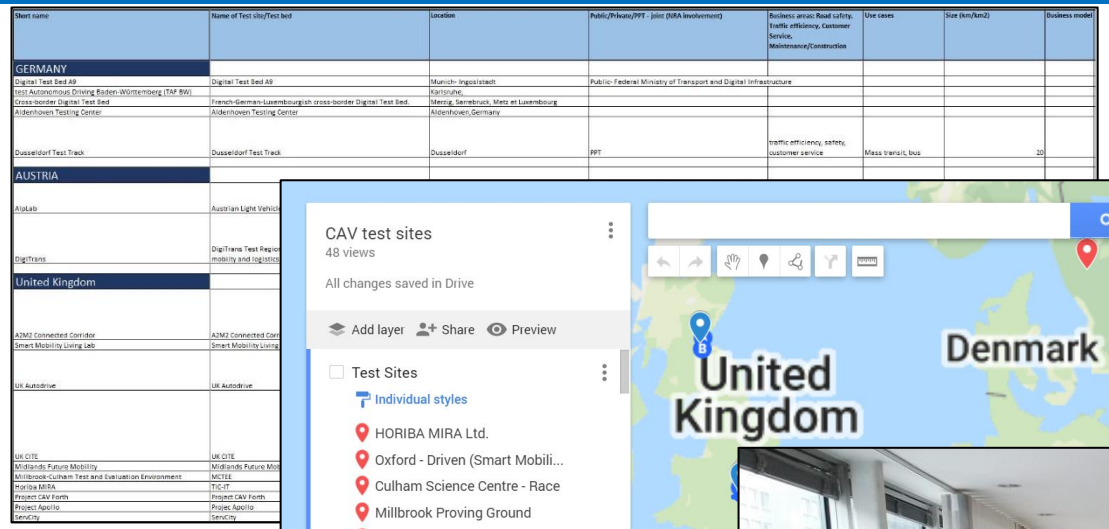
Proceedings of 8th Transport Research Arena TRA 2020, April 27-30, 2020, Helsinki, Finland

Overview of connected and automated driving test sites

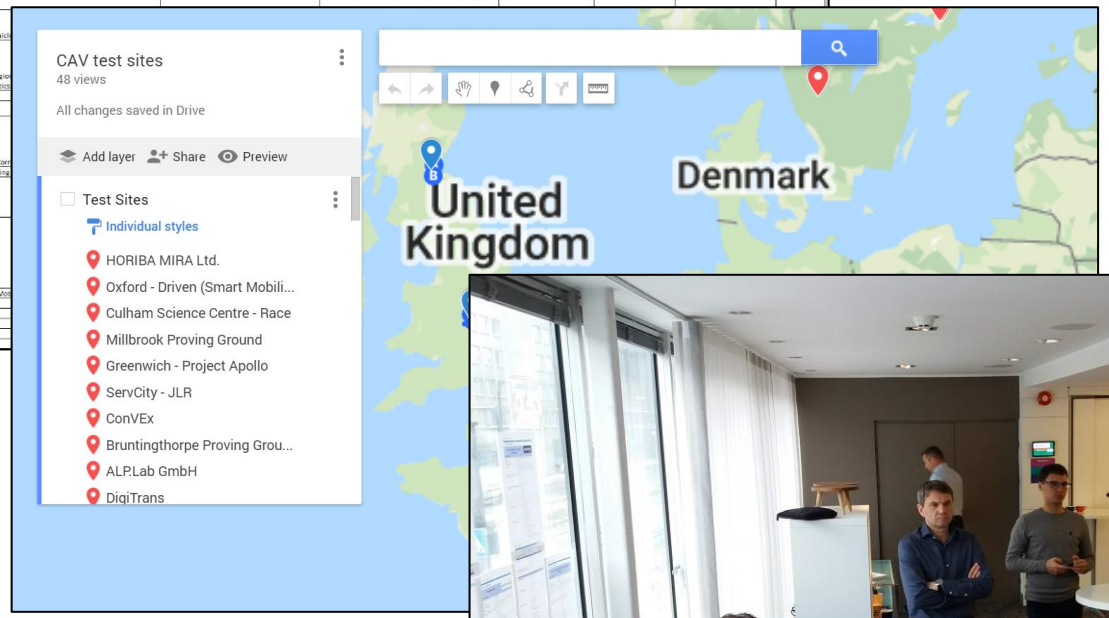
Adewole Adesiyun[a,*], Isabela Erdelean[b], Abdelmename Hedhli[c], Martin Lamb[d], Wolfgang Ponweiser[b], Niklas Strand[e], Ewa Zofka[f]

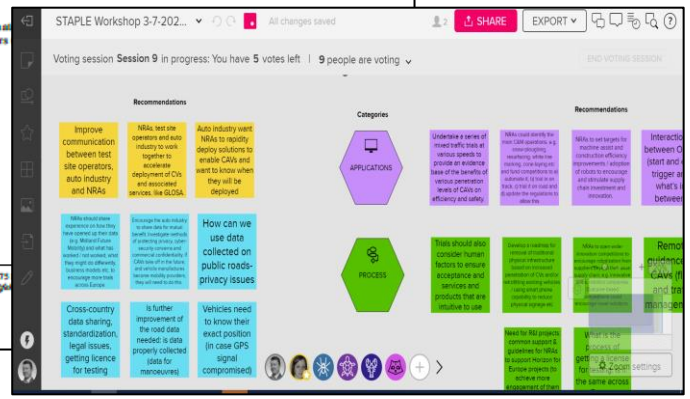
Abstract

Connected and automated vehicles potentially offer solutions to some key challenges for National Road Administrations (NRAs), such as reduction of accidents, increasing network capacity etc. As a result of this potential, both industry and certain national governments are undertaking trials that are mainly focused on technological challenges such as the ability of vehicles to drive safely in "random" situations etc. Far less attention has been paid to questions around the implications for NRAs. The overall aim of the STAPLE project is to provide a comprehensive review of technological and non-technological aspects of the most relevant connected and automated driving test sites in order to understand the impact of these sites on the NRA's core business and functions.



Short name	Name of Test site/Test bed	Location	Public/Private/PPT - joint (NRA involvement)	Business areas: Road safety, Traffic efficiency, Customer Service, Maintenance/Construction	Use cases	Size (km/km2)	Business model
GERMANY							
Digital Test Bed A9	Digital Test Bed A9	Munich- Ingolstadt	Public- Federal Ministry of Transport and Digital Infrastructure				
test Autonomous Driving Baden-Württemberg (TAF BW)		Karlsruhe,					
Cross-border Digital Test Bed	French-German-Luxembourgish cross-border Digital Test Bed.	Merzig, Sarrebruck, Metz et Luxembourg					
Aldenhoven Testing Center	Aldenhoven Testing Center	Aldenhoven,Germany					
Dusseldorf Test Track	Dusseldorf Test Track	Dusseldorf	PPT	traffic efficiency, safety, customer service	Mass transit, bus	20	
AUSTRIA							
AlpLab	Austrian Light Vehicl						
DigiTrans	DigiTrans Test Region mobility and logistics						
United Kingdom							
A2M2 Connected Corridor	A2M2 Connected Corr						
Smart Mobility Living Lab	Smart Mobility Living						
UK Autodrive	UK Autodrive						
UK CITE	UK CITE						
Midlands Future Mobility	Midlands Future Mob						
Millbrook-Culham Test and Evaluation Environment	MCTEE						
Horiba MIRA	TIC-IT						
Project CAV Forth	Project CAV Forth						
Project Apollo	Project Apollo						
ServCity	ServCity						





CAV Trials 'from – to'

Current situation

Test site funder
OEM
Tech company

Technical focus

Technical Outputs

NRAs need to understand the impacts

Influence if possible

Future situation

Partner

NRA

Suppliers

Shared objectives

Technical Outputs

Poll Question

The STAPLE project developed some recommendations for future test sites. Which one of these recommendations do you think will be easiest to implement?

- **Improve communication between test site operators, auto industry and NRAs**
- **Encourage the auto industry to share data for mutual benefit**
- **Interactions between Operational Design Domains (start and end triggers and active operation), and minimum risk manoeuvres: other than stopping**

Join at
slido.com
#cedr2017

Thank you!

http://www.stapleproject.eu/