



STAPLE

SiTe Automation Practical Learning

*Joint dissemination of H2020, CEDR projects and
other initiatives related to CAVs and Infrastructure*

3rd March 2020, Brussels

- 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
 - ☐ IFFSTAR (now Université Gustave Eiffel) France
 - ☐ MAPLE Consulting UK
 - ☐ VTI Sweden

CAV Trials

Current
situation

Test site funder
OEM
Tech company

Technical
focus

Technical
Outputs

NRAs need
to
understand
the impacts

Influence if possible

Partner

Future
situation

NRA

Shared
objectives

Technical
Outputs

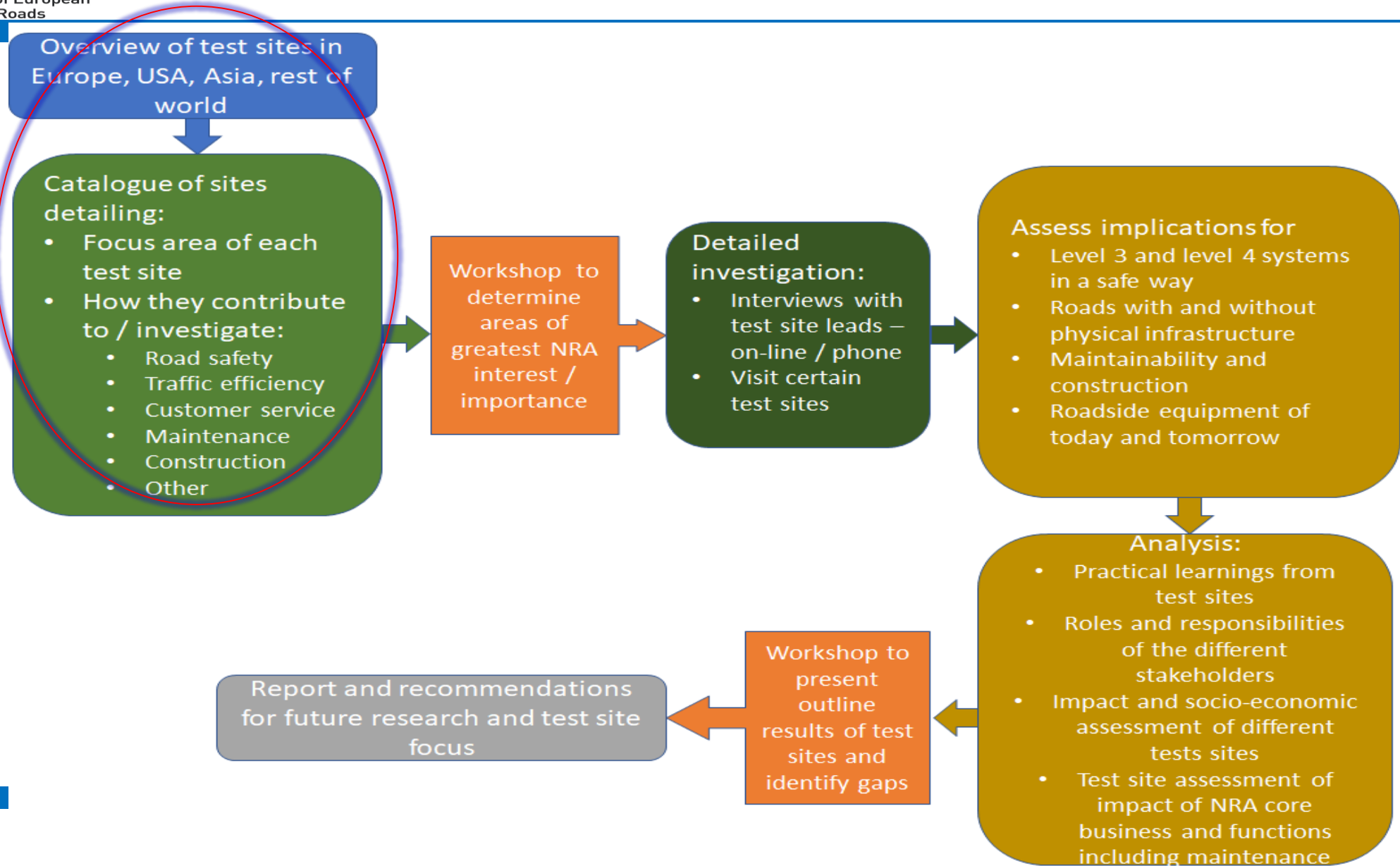
Suppliers

STAPLE aims

- to provide a review of technological and non-technological aspects of connected and automated driving test sites to NRAs.
- provide NRAs with the know-how that will support the core business activities of road operators (road safety, traffic efficiency, customer service, maintenance and construction).

Outline of general methodology

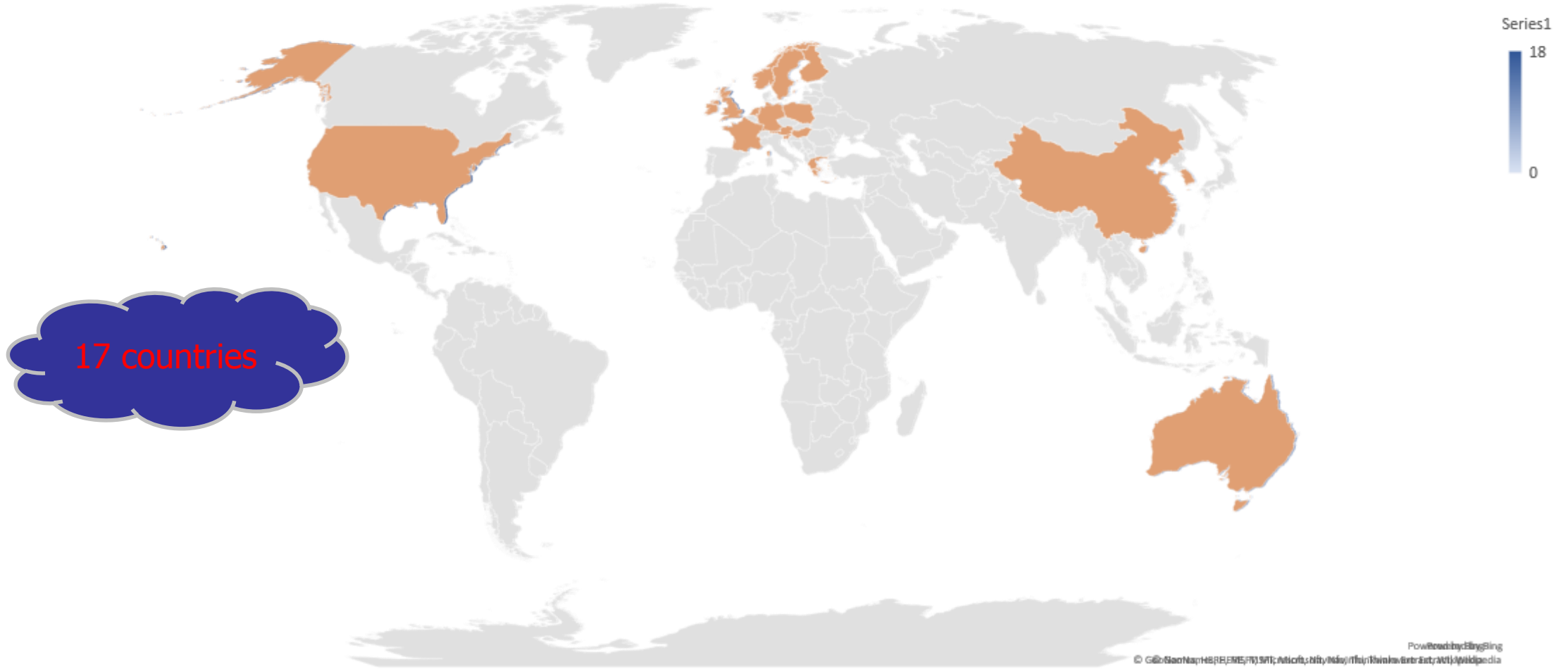
1st Phase



- **Review** through desk research, literature survey, consortium network and contacts and cooperation with the PO and PEB
- Focus was on physical **test sites and test beds** and the projects associated with them
- Identified **79 test sites and test beds** in 17 countries inside and outside Europe
- Europe, USA, China, Australia, South Korea

Test Site Information

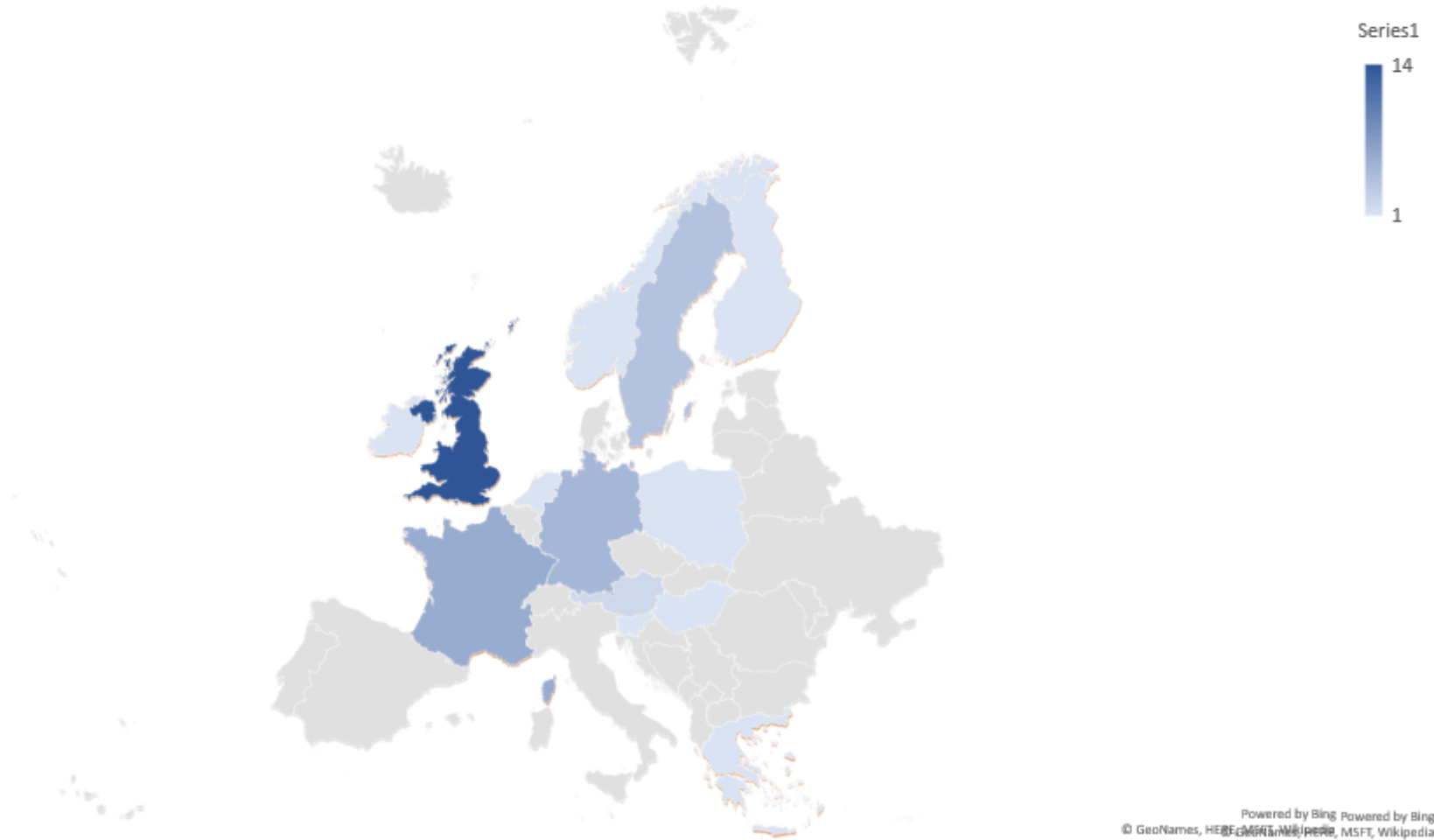
Country Test Site represented by country



Test Site Information

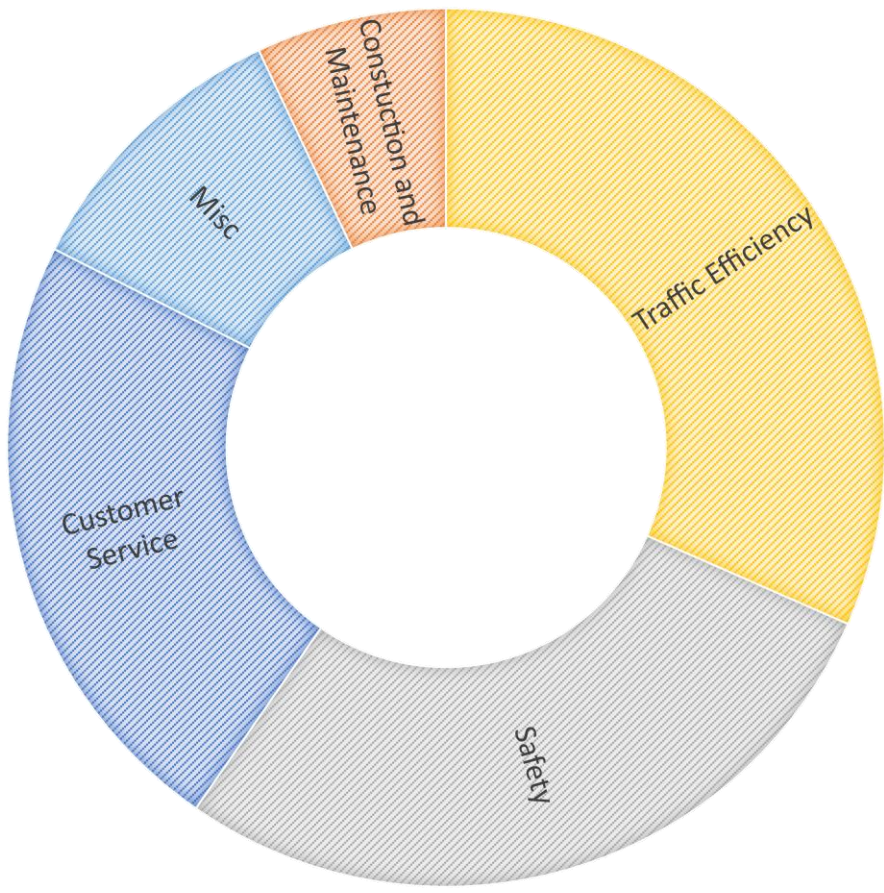


European Countries Represented



Test Site Themes

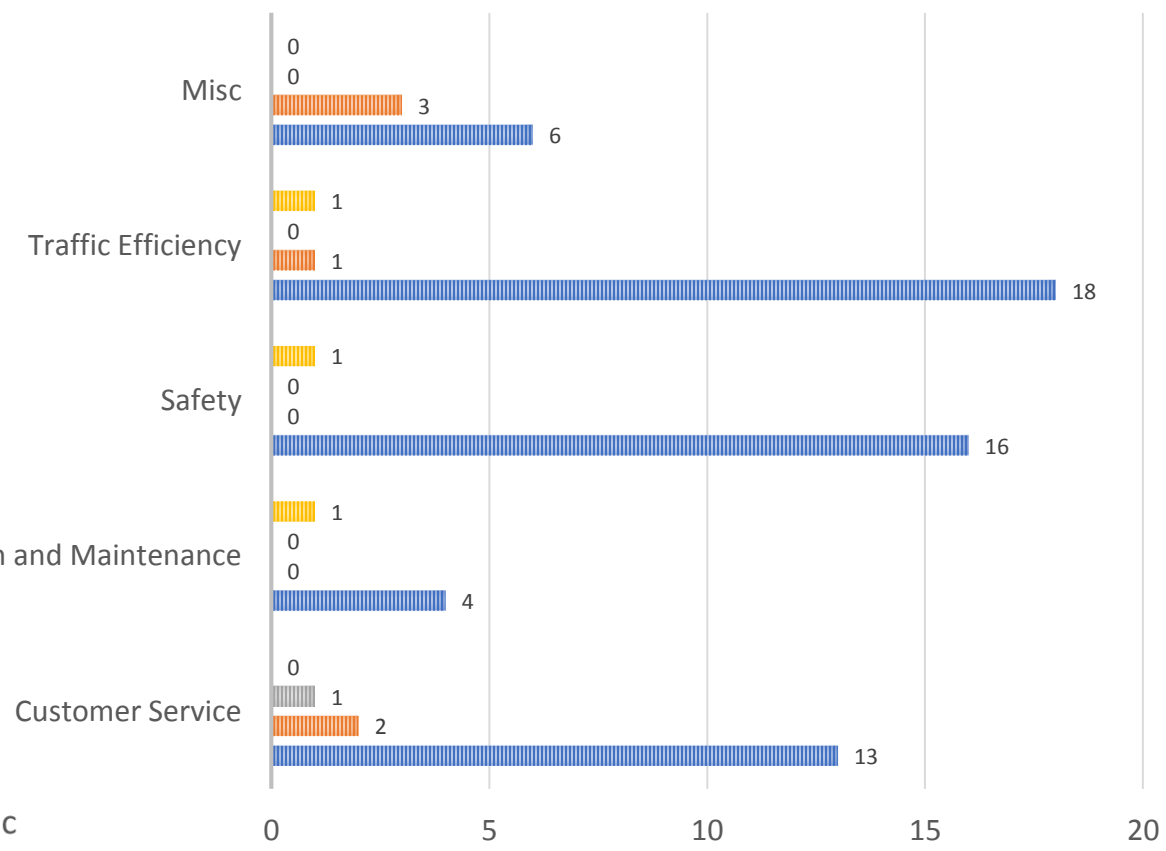
Test Sites by Theme



■ Customer Service ■ Constuction and Maintenance ■ Safety ■ Traffic Efficiency ■ Misc

Test Sites by Region

■ South Korea ■ USA ■ Australia ■ Europe



- Developed 2 templates for test site data collection:
 - Test site **Description form**: Word document,
 - Excel sheet

- **13 criteria** considered

- Description form sent to 55 test sites and test beds operators/managers/owners

Information to be collected	
Name	Project, Tests performed (past/current projects)
Location	Type of environment (e.g. motorway, interurban; intersections, signalisation, tunnels)
Type of ownership (Public/Private, PPT; NRA involvement)	Communication Systems (ITS G5, 3G/4G, etc)
Business areas (Road safety/Maintenance/Traffic efficiency)	Infrastructure support (digital, physical)
Use cases	Other specific characteristics
Size	
Business model	
Environment (open/closed)	

➤ Excel sheet version of the Catalogue

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 Vehicle Proving Region for Automation Driving	near Graz, Austria	PPT-joint (Ministry of Transport, FFG); AVL, MAGNA, TU Graz, Virtual Vehicle, Joanneum Research; ASFINAG is a setup partner	Safety	MIL, SIL, HIL, VIL automated driving in logistic applications from virtual testing, laboratory settings to driving on public roads	N/A	
DigiTrans	DigiTrans Test Region for automated driving with focus on freight mobility and logistics aspects	Upper Austria, Austria	PPT-joint (Ministry of Transport, FFG) (ASFINAG is a supporter per LOI)	Traffic and Logistics Safety and Efficiency			
United Kingdom							
A2M2 Connected Corridor	A2M2 Connected Corridor	London / Kent UK	PPT-Highways England, Kent County Council, Transport for London, UK Department for Transport, InterCor, ERTICO	Traffic efficiency / customer service	Probe vehicle data to roadside, green light optimisation, speed assistance (GLOSA), in-vehicle signage	119 km (including future stages) connected corridor	
Smart Mobility Living Lab	Smart Mobility Living Lab	London	PPT	Traffic efficiency / customer service	Urban environment	N/A	
UK Autodrive	UK Autodrive	Milton Keynes and Coventry	Public	Customer Service, Road Safety	Pods in urban areas looking at cyber security, insurance and customer acceptance		Business models being tested
UK CITE	UK CITE	West Midlands	Public	Road safety, customer service	In-vehicle signage	68	
Midlands Future Mobility	Midlands Future Mobility	West Midlands	PPT	Wireless networks, public		50 miles	
Millbrook-Culham Test and Evaluation Environment	MCTEE	Oxfordshire / West Midlands	PPT	Road safety, traffic efficiency	Urban environment, 5G	70km / 10 km (2 sites)	
Horiba MIRA	TIC-IT	West Midlands	Private	All	CAV and traditional driving	2km currently	
Project CAV Forth	Project CAV Forth	Edinburgh	PPT	Traffic efficiency / customer service	Driverless bus	~20km	Full site driver
Project Apollo	Project Apollo	Greenwich, London	PPT	Traffic efficiency / customer service	Driverless taxi	~20km	Taxi
ServCity	ServCity	Conventry / London	PPT	Customer service, congestion	Mobility service	?	Premium mobility

- The collection procedure yielded detailed data on **39 test sites and test beds**
- All Description forms were collected and processed into a **Catalogue of connected and automated test sites**



- First **assessment and pre-selection** of test sites/beds for further investigation
- **Five criteria** were considered
 - Purpose (use cases of interest)
 - Location (Europe, PEB country)
 - Availability of data
 - Longevity of site/bed
 - Confidentiality level
- The assessment yielded **14 sites in Europe** for further consideration

1st Phase

Catalogue of sites detailing:

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

2nd Phase

Workshop to
determine
areas of
greatest NRA
interest /
importance

Detailed investigation:

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

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

Workshop to
present outline
results of test
sites and identify
gaps

Report and recommendations for
future research and test site focus

2nd Phase – test sites 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
European test sites were
organised

Aim:

- Data collection of test sites
- Assess test sites' business cases
- How test sites support and impact the core business and functions of NRAs.

How?

- Stakeholder survey
- Test site visits

Stakeholder survey

The survey questions were designed to provide high level answers on how NRAs can benefit from the automated and autonomous driving test sites.

- 2 Sites: Midlands, ConVex
- 1 Site: Aldenhoven Testing Center
- 1 Site: ZalaZONE
- 1 Site: Testsite for Connected and Automated Driving Helmond
- 1 Site: AV Living Lab
- 1 Site: TRANSPOLIS
- 1 Site: Catalonia
- 1 Site: ALP.Lab
- 1 Site: Trikala CityMobil2 ARTS demonstration



Test site visits

The sites identified for the visits were selected to address most of the NRAs priorities in automation of road transport.

- Test sites in the UK: [Horiba MIRA](#) (priority areas of Road Safety, Traffic Efficiency, Customer Service) and [Midlands Future Mobility](#) (priority areas of Road Safety, Traffic Efficiency, Construction and Maintenance, Customer Service)
- Test site in Austria: [ALP.Lab](#) (priority area of Road Safety)
- Test site in France: [TRANSPOLIS](#) (priority areas of Road Safety, Traffic Efficiency, Customer Service)



Transpolis testing environments (pic provided by Transpolis)



Transpolis rural/highway testing area (pic provided by Transpolis)



Outline of general methodology

1st Phase

Catalogue of sites detailing:

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 - Customer service
 - Maintenance
 - Construction
 - Other

2nd Phase

Workshop to determine areas of greatest NRA interest / importance

Detailed investigation:

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

3rd Phase

Assess implications for

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Workshop to present outline results of test sites and identify gaps

Report and recommendations for future research and test site focus

Practical learnings

- Demonstration tests and private tests.
Demonstration like tests are mainly for public relations.
Private tests are the ones where novel features and functionalities are tested.
At such tests data, results are kept secret. Even for the test sites themselves it is difficult to collect relevant data.

Practical learnings

- In the same way OEMs are reluctant with sharing data the same is for test sites.

Consequently, NRAs should focus on getting access to this information. To improve this situation, it is key to establish trustful cooperation between NRAs, the test sites and the OEMs. An initiative could be to create contract templates that can serve as a base for such a cooperation.

Practical learnings

- As most of the test sites provide physical test environments, they are not dedicated to specific automation levels. Many test sites cover all SAE levels or have the potential to host testing activities on automated driving systems on the higher levels of automation.

Outline of general methodology

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

1st Phase

Catalogue of sites detailing:

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

2nd Phase

Workshop to determine areas of greatest NRA interest / importance

Detailed investigation:

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

3rd Phase

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

4th Phase

Report and recommendations for future research and test site focus

Workshop to present outline results of test sites and identify gaps

1. Catalogue of connected and automated test sites

- ☐ Searchable database will provide NRAs with an overview of the most relevant test sites in Europe and beyond

2. Report on practical learnings from test sites

- ☐ NRAs will have comprehensive knowledge on technological and non-technological aspects of test sites

3. Report on NRA impact and socio-economic impact assessment

- ☐ Report on how sites focus and align areas of concern to NRAs
- ☐ Socio-economic assessment investigating test site consideration of how humans will interact with connected and automated vehicles

4. Report on final recommendations for future test sites

- ☐ Provide NRAs with recommendations and practical guidance for future test sites, addressing key needs and gaps not covered by current sites

- There is no single prototype of a CAV test site. They differ in testing environment (highway, urban, interurban), type of facility (open and closed tracks, off-road trial, data trials and simulation trials), use cases covered (e.g. highway chauffeur, platoons and HD mapping), priority areas (safety, traffic efficiency, ...) and role of NRA at the test site (shareholder, stakeholder, road provider, ...) and many more like size, additional infrastructure and facilities.

- The considered use cases show that there is a huge potential for savings and efficiency gains for NRAs either by potential reduction of infrastructure, higher fluidity and harmonization of the traffic or reduced human workload. All priority areas of the NRAs can benefit from road safety, traffic efficiency, customer service as well as maintenance and construction.

Conclusions

- At some stages of the CAV development an infrastructure supporting automation functions will be required. In such cases a CAV ready infrastructure is requested by the customers (drivers of the CAVs) not only on highways but also on interurban roads this comes with huge investments. NRAs need to become aware of such a potential situation and prepare and align roadmaps to avoid these investments.

- One of the key questions for NRAs is their relation to test sites. Several options have been identified from a simple stakeholder role, up to a pure road provider, project related and/or contractual partnership up to a shareholder of the test site. Out of the 39 identified test sites there are examples for all these roles of the NRA.

The stronger the relation between the NRA and the test site, the more NRAs benefit in terms of data and information access, insights collected as well as the ability to steer the direction and focus of the test site.

Thank you!



<http://www.stapleproject.eu/>

Acknowledgement

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