Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

STAPLE

Draft findings and recommendations for future test sites – for review

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1 Introduction

The CEDR Transnational Research Programme was launched by the Conference of European Directors of Roads (CEDR). CEDR is the Road Directors' platform for cooperation and promotion of improvements to the road system and its infrastructure, as an integral part of a sustainable transport system in Europe. Its members represent their respective National Road Authorities (NRA) or equivalents and provide support and advice on decisions concerning the road transport system that are taken at national or international level.

The participating NRAs in the **CEDR Call 2017: Automation** are **Austria, Finland, Germany, Ireland, Netherlands, Norway, Slovenia, Sweden** and **the United Kingdom**. As in previous collaborative research programmes, the participating members have established a Programme Executive Board (PEB) made up of experts in the topics to be covered. The research budget is jointly provided by the NRAs as listed above.

The aim of the Site automation practical learnings (STAPLE) project is to provide a comprehensive review of technological and non-technological aspects of the most relevant connected and automated driving test sites across Europe and beyond, in order to understand the impact of these sites on the NRA's core business and functions. This project will provide NRAs with the necessary know-how on connected and automated driving tests sites and test beds, with the aim of supporting their core business activities, such as road safety, traffic efficiency, customer service, maintenance and construction.

The STAPLE project consortium will support the NRAs through the following objectives:

1. Provide an overview of connected and automated test sites/beds in Europe and beyond
2. Provide a catalogue of these sites and detail how they contribute to NRA priorities
3. Undertake a detailed investigation into a selected number of test sites including visiting a selection of sites
4. Assess the implications of the findings of the test sites for future NRA options
5. Analyse and report on the practical learnings from test sites worldwide, including gaps where NRA needs are not addressed
6. Provide a report and recommendations for future research and test sites focus.

Objectives 1, 2, and 3 were covered in work package 2 and 3, and objectives 4 and 5 in work package 4, while objective 6 will be targeted in the upcoming work package 5.

In work package 4 specifically, *Analysis and impact assessment of test sites*, the goal was to provide an analysis of data collected in previous work packages, and thereby provide a summary of the practical learnings and insights gained within the STAPLE project. The work includes a detailed analysis and impact assessment of key performance areas, providing an overview of practical learnings from the test sites. Furthermore, work package 4 deals with assessments of the impacts of different test sites, as well as socio-economic impacts.

This document summarises the findings and recommendations prepared in the final deliverable of Work Package 4. We wish to get stakeholder views to challenge and validate the recommendations and add new recommendations if appropriate. These will be reported in the final deliverable of Work Package 5 along with a summary of the work undertaken.

2 Findings

During work packages 3 and 4, a greater investigation of test sites was undertaken along with an understanding of how CAVs can impact on road administration operations, and test sites to reflect this. From the work undertaken, a number of findings were collected and grouped into the following categories:

Communications

- Test site operators are generally reluctant to give detailed information about their sites
- Auto industry / OEMs reluctant to share data but will work on industry groups

Testing

- Whilst there are a lot of simulation activities to assess the benefits / effects of CAVs in mixed traffic, there are few physical tests. Physical tests include individual vehicles driving autonomously or platoon trials. Mixed traffic trials on sites / roads, could demonstrate clearer benefits of having CVs and at what penetration they would make a difference.
- Most activities required by NRAs are covered at various test sites
- Closed test tracks offer an excellent opportunity for undertaking high speed and/or dangerous tasks that could not be undertaken on public roads
- Some of the on-road test sites can provide excellent capabilities for testing

Applications

- The development of AVs had not advanced to the extent envisaged at the start of the project and appear to be >15 years away (for level 5)
    - This means that traditional physical infrastructure needs to be in place for some time.
    - Acceleration of CV capabilities would benefit from addition of infrastructure such as 5G, radio signs, I2V etc
- CVs are becoming more common place and can offer shorter term benefits, e.g. lane assist, traffic jam assist, adaptive speed control, GLOSA, parking assist and valet parking. All offer benefits to safety, efficiency and customer service and the deployment could accelerate higher SAE levels.
- Connected and autonomous plant can offer significant benefits to safety, welfare and efficiency at certain plants, whether machine assist to improve accuracy/avoid obstacles, remote operation or fully autonomous operation in certain locations.

Data

- NRAs offering data for others to test new products / processes / applications (e.g. ConVEX, Midlands Future Mobility) can be an excellent way to help develop capabilities that will benefit the NRA
- The auto industry is unwilling to share data (except through specific project like ConVEX. More sharing of data could lead to significant advances.
- NRAs do not necessarily value the data they hold to the same extent.

Process

- For some projects, there is a step by step process for going for track trials, then public road trials, then deployment, e.g. Colas impact protection vehicle, recent UK cone laying trials,

- Other times, this is not done in such a coordinated way
- Innovative contractors (e.g. Colas, WJ) have invested in robotization and are willing to more, but likely need certainty that NRAs will approve and adopt it, and/or support their innovation efforts.
- There are likely to be non-transport robot developers / manufacturers / programmers who could address NRAs / NRA supply chain needs, if they were engaged

Summary

Despite the various findings, it should be recognised all actors involved in CAM have shared objectives, including;

- Reduce KSIs, mainly because of the personal tragedy, but they also cost society money directly (insurance pay-outs, investigations) and indirectly (loss of potential taxes, disruption at the time of accidents),
- Improve traffic flow and efficiency – greater journey time reliability and smoother traffic. Also, less polluting, so cleaner air,
- Increase mobility options through shared mobility, repurposing road or parking space for cycling / walking / new micro-mobility options,
- More efficient road maintenance, results in less disruption to road users and a reduction in costs incurred due to delays or diversions, higher customer satisfaction and improved road quality. There should also be the potential to reduce the costs of works and save tax payers' money.

There are also shared risks from CAM. There is high potential for contradicting these outcomes by rebound effects. The ease of use and limited cost of CAV services makes them very popular, and demand for traditional transport modes will dramatically decrease, prompting severe cuts in public transport and the reduced use of non-motorized modes. How such increases in road travel will affect traffic congestion remains highly uncertain and is dependent on the degree in which automated vehicles will be capable of "coordinating" themselves for a better use of the roads. As a consequence, road trips may slow down, and more time is spent in cars. This increases the opportunity cost of time of car travel.

3 Recommendations

Communications

- Improve communication between test site operators, auto industry and NRAs
    - Consider setting up working groups (if they don't already exist) to learn from each other and better understand their business priorities.
- NRAs, test site operators and auto industry to work together to accelerate deployment of CVs and associated services, like GLOSA.

Data

- NRAs should share experience on how they have opened up their data (e.g. Midland Future Mobility) and what has worked / not worked, what they might do differently, business models etc, to encourage more trials across Europe.
- Encourage the auto industry to share data for mutual benefit. Investigate methods of protecting privacy, cyber-security concerns and commercial confidentiality. If CAVs take off in the future, and vehicle manufactures become mobility providers, they will need to do this.

Applications

- Undertake a series of mixed traffic trials at various speeds to provide an evidence base of the benefits of various penetration levels of CAVs on efficiency and safety.
- NRAs could identify (or get us to) the main C&M operations, e.g. snow-ploughing, resurfacing, white line marking, cone-laying etc and fund competitions to a) automate it, b) trial in on track, c) trial it on road and d) update the regulations to allow this
- NRAs to set targets for machine assist and construction efficiency improvements / adoption of robots to encourage and stimulate supply chain investment and innovation.

Process

- Start with the end-goal in mind! Consider what success will look like for research projects at the outset, so a defined process of simulation, lab, track and road trials can be undertaken
- Aligned to the above recommendation should be to consider social equity in trials to ensure that, no group will be marginalised from mobility (e.g. through cost or access / capability of use of technology).
- Trials should also consider human factors to ensure acceptance and services and products that are intuitive to use and/or ergonomically designed for all levels of personal mobility.
- Develop a roadmap for removal of traditional physical infrastructure based on increased penetration of CVs and/or retrofitting existing vehicles / using smart phone capability to reduce physical signage etc
- NRAs to open wider innovation competitions to encourage robotization from suppliers beyond their usual supply chain, e.g. innovative SMEs, robotics companies. Outcome based competitions could encourage novel solutions.