Interreg North-West Europe

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SUMMARY PAPER ON BEST PRACTICES LEARNED FROM THE INTERREG GREATER REGION TERMINAL PROJECT D.1.1.3

Interview with Isabelle Rösler, researcher applied sciences, HTW Saarbrücken, regarding the INTERREG-project TERMINAL in the French/German/Luxemburg border-region.

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LEAD AUTHOR:

Gemeente Almere

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INTRODUCTION TERMINAL-PROJECT

In the period 2019-2022 two cross-border AV pilot-projects were conducted in this region. The first pilot was originally planned as an AV-service with 15-seater shuttle busses between Creutzwald (France) and an industrial area over the border in Germany. This 16 km-route ran through urban area and provincial roads. The second pilot was an Automated On-Demand service, connecting Luxemburg with Thionville in France. Cross-border areas are traditionally poorly served by traditional public transport and AV (on Demand) might form an interesting and cost-effective solution to fill in this gap.

The focus of the project was really set on the cross-border character of the experimentation. Although the INTERREG-project CAMINO does not involve international cross-border context, the legal and authorities issues in regional cross-border contexts are very comparable.

The overall aim was to clarify legal and technical requirements regarding the infrastructure and the vehicle to be used, analyse user acceptance and the cost structure of the services.

A kind of guide to transport operators has been offered how to approach AV from different point of views. An overview of the main findings (Legal, Technical, Economic and User acceptance) and results of the projects are the following:

LEGAL

The project has experienced big challenges regarding legal issues in a cross-border context. The automated vehicle must pass through a special approval process in both countries to obtain a driving license for a specified route.

This approval process is complex and time-consuming and are in different in each country. Issues to be addressed are: submission of an application with all details regarding the description of the test, the conditions of the experiment (location, date, type, and numbers of the automated vehicle to be used, the characteristics of the concerned tracks, required infrastructure equipment, interactions with other usual vehicles, presence of a supervisor), authority in charge of organizing the transport, information for the public, security, cyber security analysis, consultation of stakeholders.

Despite the existence of a Franco-German-Luxembourgian working group within the three involved transport ministries collaborating in the DFL-test field for cooperative and automated driving, no solution could be found to speed the process and allow the desired mutual recognition across national borders of vehicle approvals.

6 years later, this mutual recognition is still not legally regulated.

TECHNICAL

The pilot ran into many technical challenges to find an appropriate automated shuttle answering the requirements for a long test track (16 km) at a higher speed - not a last mile use case as usually seen during this period in other projects driving at 15 km/h.

Despite 5 attempts within European calls for tenders to find an appropriate AV, the market was not mature and did not hold its promises for SAE-level 4 vehicles for public transport issues. Instead, in the pilot a Tesla-model was chosen as an alternative.

Regarding the degree of automation achieved by the Tesla models, 64 % of the driving distance was realized in automated driving mode at average speeds of more than 60 km/h. This said, there are significant differences in the share of automated driving mode between the five professional drivers as well as in the way they use Tesla's AP system

ECONOMIC

The additional costs incurred beyond the vehicle, such as the costs for expert opinions on the route (operating range) and vehicle homologation, software, and training of personnel should not be underestimated and are in the high six-figure euros.

From this background, economical operation of the tried and tested transport service can only be achieved, if the safety driver can be completely removed in the future and the remote technical supervisor oversees many automated vehicles.

USER ACCEPTANCE

Contrasting with results from other projects, speed, and security feeling do not contradict each other. High levels of satisfaction of above 90% were achieved in het pilot-project and all values regarding user experience during travelling, increased with repeated usage (sharing the car, comfort, breaking, secure feeling).

Regarding the planning of the mobility (on demand) service however, acceptance highly depends on the degree of flexibility offered. Little spatial and temporal flexibility, compared to individual cars, represents a barrier for usage and for on-demand offers.

THE PILOT-PROJECTS IN MORE DETAIL

The main impacts of this change in AV-vehicles from a 15-saeater shuttle to a Tesla in the first pilot were diverse and had an impact on the whole project results:

- Using Tesla cars – had as a consequence that the pilot could only conduct the test in a level 2+ of autonomy which was less than level 3 as planned. Partial automation means that the system only takes over steering, acceleration and breaking but requires that the driver still must observe the surroundings and takes over all remaining aspects of the dynamic driving tasks.
- The Tesla model X already had a type-approval. Therefore, no special authorization was required to conduct the test and the prepared application at the French ministry beforehand was not necessary anymore.
- Results regarding the acceptance differ from studies conducted with low-speed people movers mainly regarding comfort and safety. It shows that a high driving speed is not in contradiction with safety perception. Instead, the high travelling speed positively affects the intention of future use of automated transportation services for longer rides. As a Tesla and an automated minibus are very different vehicle types, the acceptance cannot merely be explained by the automated driving system. Indeed, it appears that a more comfortable vehicle interior makes the ride enjoyable. This contributes to the satisfaction among passengers as well as their readiness for sharing. Therefore, it appears interesting for future developments of automated shuttles to examine thoroughly how driving motion parameters and comfort in general can influence feelings of safety and trust and how far these factors can better predict the behavioural intention to use automated vehicles. This also holds for the improvements of the interior design of automated shuttles.

Due to the difficulties in the procurement of the automated vehicle, the pilot phase had to be reduced to only 3 months instead of half a year as initially planned. Moreover, the test was conducted in Summer 2021, i.e. the COVID-19 crisis was still not finished. In this context, there was a low interest in sharing mobility solutions and some of the companies partly faced an economic crisis /short-time work).

Thus, the potential number of users was reduced and for health reasons it was decided to allow only 2 passengers per drive. Depending on the day and shift to be covered, the service was used by one to 5 passengers per day. All passengers involved during the test also received a questionnaire post-trial to assess their attitudes towards AV and their intention for a potential future usage and willingness to pay.

During the pilot the service was free of charge. This aspect probably affects the appreciation of the service. In the post-trial poll, 64% of the respondents mentioned they would use the shuttle (value 4 and 5 on a 5 points scale) in the future if this one were not free of charge

The research showed a high level of appreciation/acceptance by customers. Both, the fact that this public transport-service didn't exist before and the AV-character of the service, has affected this high appreciation. the offer of such a service itself takes a great place on the positive appreciation. The type of vehicle used (Tesla model X) was also exciting, but the AV character of the service also had a positive influence on the appreciation, as a future solution to ensure mobility in rural areas while the number of bus drivers gets very short.

The evaluation-study showed that the AV-vehicle on average drove between 63-70% of the time automated, and that the driver had to take over/intervene in ca. 25% of the time. The implication of this is, that a driver is still needed during the whole trip and that the reduction of costs and staff therefore can not be realised.

However, these results are based on the usage of a vehicle in SAE level 2 that requires the driver to take over manoeuvres. With a shuttle in SAE level 3 or 4 of automation, the degree of driving in automated mode is expected to be much higher. Driverless operation seems to be challenging in roundabouts and intra-urban settings when parking cars on the roadside partly block the roads. Based on these results it is envisaged that Level 4 driving will be possible in the future, but it will highly depend on the environment.

Since staff-costs form 60% of total costs for a PT-service, it is hoped that AV-concepts will bring affordable PT-concepts for rural areas, closer-by. However, not in the short or medium term. Affordability or economic profitability requires a level 4 of autonomy where the system can undertake all manoeuvres, and no safety drivers is necessary. However, the German legislation foresees very strict requirements for the remoted technical supervision in terms of qualifications. Substantial investments are required for transport operators. This means the personal costs from driving operators would be transferred to costs for the remote supervision. To reach a break-even point, the ratio between the number of automated shuttles to be controlled by one supervisor must be very high (more than 10 vehicle for 1 supervisor).

The second project (Luxembourg-Thionville) never really got started because the vehicles were not allowed into France. Therefor the AmoD-system was tested solely in Luxemburg. Nevertheless, the project learned that it is feasible to drive in automated mode at a speed of nearly 30 km/h in normal traffic.

The demo allowed to showcase the capabilities of the platform and raised awareness about automated driving technologies to a wider audience. The public road experiments were centred around an approximate 3km loop in the Kirchberg area of Luxembourg City, chosen because it provided a diverse set of driving scenarios under moderate traffic conditions while remaining accessible for experimental ADS.

LESSONS LEARNED

- Invest in education and awareness
- The more knowledge people get, the more confidence they will have in the technology
- Demonstrations are the best way to create trust and get aware of its benefits
- Digital infrastructure is the backbone of automated mobility
- Communication between vehicle and infrastructure is very important to ensure road safety
- A 5g network to ensure connectivity at the border is essential
- Allow cross-border pilot project by means of legal exemptions if a mutual legal frame cannot be achieved at short -term
- Regulatory hurdles must be eliminated