

Experiences with planning and construction of the ELISA pilot site / eHighway Hessen

M.Sc. Igor Rudgartser¹

Dr.-Ing. Achim Reusswig

¹ *Hessen Mobil Road- and Traffic Management, Frankfurt/Main, igor.rudgartser@mobil.hessen.de*

Summary

In just 2 years, a catenary ERS ELISA - eHighway Hessen was planned, approved and erected on the highway A5 between Frankfurt and Darmstadt at a section length of 5 km each in both directions. This was the first plant of this kind on a highway in Germany. Therefore, there were only few reliable findings or legal foundations at the beginning of the project. At the same time, the passive vehicle restraint system in the area of the plant was renewed. The article presents the ambitious goals of the overall project and the path to successful realization.

1 Research Questions

The ELISA pilot site (ELISA stands for “Elektrifizierter, Innovativer Schwerverkehr auf Autobahnen”, german for: “Electrified, Innovative Heavy Freight Transport on Highways”) should be built on the highway A5 between Frankfurt and Darmstadt at a section length of 5 km each in both directions within two years. This meant that within this short period:

- The legal status of an eHighway had to be clarified for the first time in the public road area of Germany
- Legal building permission had to be obtained
- The Planning of a new technical system which must be compatible with the findings of partially parallel ongoing projects, had to be carried out
- The EU-wide tender procedure for the construction of the plant had to be carried out
- The construction, commissioning and acceptance of the plant had to be carried out
- A new passive vehicle restraint system, with the consideration of the newly constructed pilot site, had to be built

Each of these questions had to be solved in order to successfully complete the project as a whole. The biggest challenge was the very tight time schedule. The sequential processing of the questions would have taken much more time than 2 years. Hessen Mobil, however, decided to accept this challenge. The system fits excellently into the research portfolio of Hessen Mobil and blends seamlessly into the DRIVE test field Hessen (DRIVE test field stands for Dynamic Road Infrastructure Vehicle Experimental test field). At the DRIVE test field Hessen Hessen Mobil with partners from the automotive, supplier and telecommunications industry as well as scientific institutions develops and tests future traffic and mobility technologies under real road traffic conditions.

The ELISA-project was split into two parts - ELISA I deals with the construction of the infrastructure and ELISA II follow to ELISA I and uses the infrastructure created to carry out the field trial. The project is funded by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety of Germany.

Project management organization is VDI/VDE Innovation + Technik GmbH. Of course, the project is endorsed and politically supported by the Hessian Ministry of Economics, Energy, Transport and Housing.

2 Methodology

Since the sequential processing of the questions was not possible because of the extremely challenging schedule, all processes had to be carried out simultaneously. For the reason that this is the first plant of this kind on a German highway, there were no standards and precedents. Many findings had to be deduced from the comparable standards of road traffic, railways and trams.

In order to obtain the building permit, it was very important to involve all concerned parties and the competent authorities at an early stage. The existing regulations and possessions could not be endangered by the project. The proactive involvement of all stakeholders should be maintained by Hessen Mobil throughout the lifetime of ELISA I. This was intended to improve the acceptance of the project.

Another challenge was the design of the tender documents. It was neither possible nor appropriate to design a detailed "classic" performance specification, because of missing references as standards or guidelines on the one hand and on the other hand the risk of too early and therefore suboptimal setting of details which would not consider the research nature of the project. For this reason, the tender was based on a functional description of the system. It was formulated the framework and the known technical requirements. In addition, a negotiation procedure was carried out to reduce the risks for both the client and the contractors. As a result of the negotiation, the terms of tender have been optimized.

Federal Highway Research Institute has communicated requirements for the type of passive vehicle restraint system needed for an eHighway system. Since the federal highway 5 in the area of the test track is a very heavily traveled section (approx. 130,000 veh / day) without speed limit, the safety requirements are particularly high. In addition, the impact behavior of the masts, especially in the practical clamping, has not been sufficiently investigated.

3 Results

First, the legal status of the plant had to be clarified for the purpose of determining the building approval process to be applied and the legal responsibilities for its execution. The decisive factor was the location of the pilot site and the purpose the system will be used for. Both are inseparable from the highway. Thus, the plant had to be regarded as road accessory and the planning regulations of the road law shall apply.

In certain circumstances – inter alia: agreement with authorities competent for protected assets, no third-party-rights affected –, German law allows a simplified and accelerated building approval process. Thanks to the early involvement of all concerned parties, goals and technology of the catenary ERS have been made transparent and a wide acceptance for the pilot site has been achieved. After all, there were no impediments for obtaining the planning permission for the plant on schedule. This was also helped by the fact that Hessen Mobil had already included in advance the technical feasibility and planning suitability as essential criteria in the selection decision for the section of track to be equipped. During the construction phase again, it was very important to keep in touch with all concerned. In this way, the challenge of setting up masts in the immediate vicinity of external cable routes could be mastered quickly and cooperatively.

Following the first offers, that entail a preliminary project design reflecting the functional specifications, and a negotiation procedure with the bidders, the tender requirements have been optimized substantially. Project risks and cost drivers could be identified and diminished, so that the remaining risks for both sides have become manageable. It was important to gain an understanding of the research character of the project, because it had to be taken into account that even after the project started, changes in the dynamic field of research could result in a change of requirements.

The EU-wide tender procedure was successful, so that the contract could be awarded as planned, after only seven months of project duration. It was also possible to ensure that the successful bidder had the same understanding of the project as Hessen Mobil. As a result, the detailed implementation design and the construction was realized as an iterative process under active cooperation between Hessen Mobil and the contractor.

Finally, the pilot plant was built and put into operation within the specified timeframe. The ELISA pilot plant with its length of 5 km in each direction is located between the highway exits “Langen/Mörfelden” and “Weiterstadt”. Thus, the plant is located to the immediate south of the DRIVE test field of Hessen Mobil which has grown through it. In perspective, the ELISA system is to be even more integrated into the DRIVE test field, whereby Hessen Mobil expects new research impulses for the Hessian electrified highway. Parts of ELISA system are shown in Figures 1 to 3.



Figure 1: ELISA pilot site, view from the bridge 'Mittelschneise' in northern direction



Figure 2: ELISA pilot site, view from the bridge 'Mittelschneise' in southern direction



Figure 3: Substation of ELISA pilot site (Gräfenhausen-West)

In parallel to the other operations, a new passive vehicle restraint system was planned for the pilot site, tendered and commissioned under an EU-wide tender procedure and then set up. Based on a specification from the Federal Highway Research Institute, a H4b containment system had to be used. After assessing all factors, such as the distance to the masts and tipping overhangs, the requirements for the passive safety device like class of working width and class of vehicle intrusion were specified. Since no W4 working-width class system could meet the requirements of VI4 vehicle-intrusion class, a W2 working-width class system was chosen to ensure the highest level of safety. The process could also be implemented on time. The new passive vehicle restraint system is shown in Figure 4.



Figure 4: Passive vehicle restraint system of ELISA pilot site

As a result, it can be stated that the New Year 2019 in Hesse was celebrated with ELISA pilot site that was ready for operation and protected by a safe passive vehicle restraint system. Hessen Mobil now faces new challenges with the conduction of the field test and the integration of the system into the DRIVE test field in the coming years.

Authors



M.Sc. Igor Rudgartser studied mechanical engineering with a specialization in energy and process engineering at the Ruhr-University Bochum, since 2017 at Hessen Mobil Road and Traffic Management in Frankfurt in the department of Intelligent Transport Systems, subdivision Cooperative, Connected and Automated Mobility as Project Engineer for ELISA eHighway Hessen.