

CURE MODERN – Monitoring of Infrastructures in Cross-Border Regions

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1 ABSTRACT

Every era had its specific building culture and infrastructures that need continuous monitoring to sustain it. In order to be able to do that, a reliable database is required but is not available up to date. Many buildings of the sectors of transport infrastructure for example were built 50 years ago and are now requiring massive investments for maintenance. The problem is even more relevant in regions close to the border, because infrastructures like streets are cross-border, legal regulations and data sources differs from country to country. To find a solution for this problem, this is the aim of the project CURE MODERN. This project, supported by the European program INTERREG IVa, aims to show, by which approaches a comprehensive monitoring of these buildings by non-destructive methods could be deployable. Project partners besides the department CPE of the University of Kaiserslautern are Fraunhofer Institute, Centre d'Études Techniques de l'Équipement de l'Est, European Research and Project Office GmbH (Eurice), Rogmann Ingenieure, Landesbetrieb Straßenbau Saarland and the Eurodistrict SaarMoselle. Focus of content is to develop different monitoring approaches for spatial infrastructures. On a local scale, this embraces various kinds of non-destructive testing. Potential testing methods are terrestrial surveyings and laserscanning as well as airborne photography are used for inventory and 3D-modelling. The regional scale needs a webbased GI-system analysis in order to achieve a comprehensive database as well as a tool to visualize the data for decision makers. Furthermore, the aim of this project is the foundation of a regional competence network even for innovative technological approaches and for regional classification in the aspect of planning.

2 REGIONAL CONTEXT

The issue of monitoring infrastructure became increasingly more relevant in recent years in the perspectives of planners. This is especially true for cross-border areas, because the relevant infrastructures embraces national and administrative boundaries. However, there is often a lack of data for the respective objects in these areas. The INTERREG IVa project "CURE MODERN" is using new and innovative technologies to develop both regional and local approaches to testing and monitoring of infrastructure and cultural structures. The consortium for this project is made up of the Department of Computer-aided planning and design methods at the TU Kaiserslautern (CPE), in cooperation with the Fraunhofer Institute for Nondestructive Testing (IZFP) in Saarbrücken, the French authority for roads in Lorraine (CETE de l'Est) in Metz, the state office for roads in the Saarland (Landesbetrieb für Straßenbau), Rogmann Ingenieure and the Eurodistrict SaarMoselle. Besides the technical and methodological approaches also an intensive knowledge exchange is planned. In this perspective, a joint competence center for cross-border cooperation between research and industry and public authorities will be initiated.

3 PROJECT

The project will focus on exemplary objects, which are relevant in the regional context for developing new and innovative monitoring approaches. There has to be a common understand for the situation of the infrastructure as well as for comprehensible collection of the different legal circumstances from the planning and building sector. The used technologies include a variety of innovative recording techniques such as airborne photogrammetry with UAVs (Unmanned aerial vehicle), photogrammetry or terrestrial laser-based scanning. Furthermore, some concepts about how to share this information with relevant decision takers will be examined.

The test subjects were picked in order to achieve as complementary as possible approaches of testing methods. For the representative cultural buildings, a church in Metz/France (Eglise Ste. Thérèse) as well as a restored castle in Manderen/France (Château Malbrouck) was chosen. Both are reflecting a different building style which is exemplary for monitoring purposes. The focus for monitoring transport infrastructure was especially put on bridges in the project area. The first examination objects are the "Grumbachtalbrücke", which is placed on a German highway and a bridge on a national street in Rosbruck/France. The first project

focus lies on the examination of the two bridges. In a first step, a model of the object will be developed out of the various data sources (electronical property data and innovative non-destructive surveying methods) in order to use it for further elaborations of the potential damages. This data will be available on a self-developed, web-based information system.

3.1 Non-Destructive testing methods for the bridges

The subsequent pictures show the first object for the examination. Based on legal property data, a 3D-model was built. In a next step, an UAV (Unmanned aerial vehicle) will be used to take detailed pictures of damages at the construction. Furthermore, the Fraunhofer Institute will conduct some concrete testings in order to get information about performance of the pre-stressed concrete. These results will be visualized with the 3D-model for politicians and decision takers to have a fundament, how to act on further reparations of the object.



Fig. 1: 3D-Model with a sufficiently level of detail for a damage localisation (Own source)



Fig. 2: Screenshot from Autodesk Navisworks for visualizing construction damages (Own source)

3.2 Web-Based-GIS & Database for project buildings

Parallel to the tests of the various objects, a web-based platform with a common database is developed. The web interface allows besides the official website (www.cure-modern.eu) access to geographical information of the project area as well as relevant information for the test objects. The goal is to develop a common tool which gives information about the local conditions of the different buildings. Besides security-critical data, all data could be downloaded as geographical dataset or as textfile.

The technical realisation is completely founded on open-source-software. Geodata and attributes are store in a PostgreSQL/PostGIS-database, witch is richly equipped with geoprocessing funcitonality. Furthermore geoserver renders and provides our data as WMS, gives a writeable acces through WFS-T and enables an flexible data. On the clientside, openlayers ist configured as a web-based interface. It's javascript-library is able to allow various kinds of requests. Both Geoserver and Openlayers are developped and promoted as OSGeo-projects. The subsequent picture shows the web-plattform with its basic functionalities which will be extended in the future.

CURModern

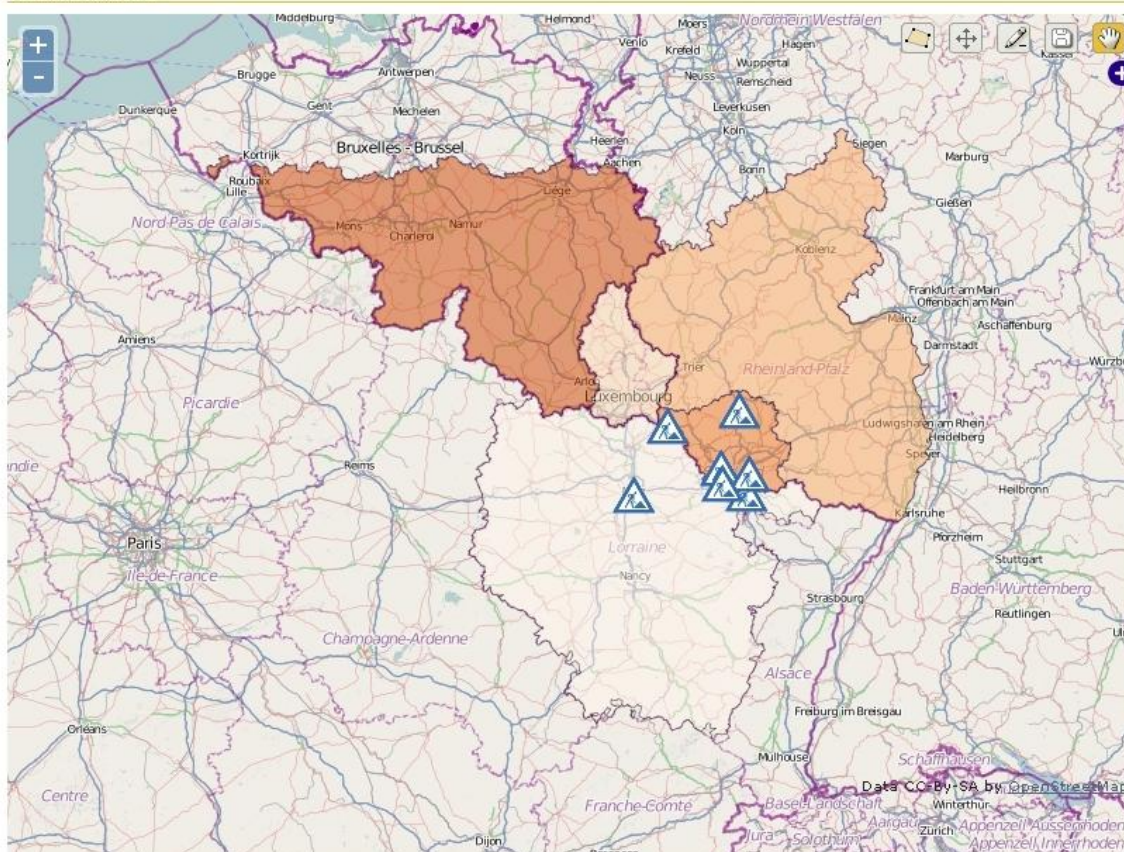


Fig. 3: Web-Interface CURModern (Own source)

4 CONCLUSION

The important fact of this project is the cross-border approach for the monitoring methods. Whereas innovative testing methods for various kinds of buildings have been previously developed, the situation in the project region with many partners is much more complicated. Hence, aim is besides new technical solutions and potential benefits for homogenization of legal regulation is to learn from each other and develop cross-border monitoring approaches.

For the upcoming project time, more innovative and non-destructive test methods will be realized with the presented and planned study objects. In addition, new testing methods (airborne laser and radio scanning for example) will be developed. The common cooperation should be strengthened by cooperative work at a Wiki as fixpoint for the project related knowledge. Based on this, the foundation of the regional competence network will be accelerated and the scientific discourse will be pushed forward by a conference in Nancy (France) in March 2014.



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