

SAVCOR DEVELOPS

SMART BRIDGE MONITORING IN FINLAND

Savcor has been developing smart monitoring for Finnish bridges already for ten years. As a result of successful development projects, the Finnish Transport Agency ordered a smart structural health monitoring system from Savcor. The order is based on a three-year service contract and the monitoring system is installed Kirjalansalmi Bridge located between Finnish cities Kaarina and Parainen.

BACKGROUND IN SUCCESSFUL RESEARCH PROJECTS

The new way to monitor the life cycle of the Finnish bridges started with a research project coordinated by **the Technical Research Centre of Finland VTT**. The project was titled **Monitoring of the Bridges SIMO** and it was funded by the **Finnish Funding Agency for Technology and Innovation TEKES**.

One of the research targets in the project was **Kirjalansalmi Bridge**. The goal of the project was to study how the condition and remaining service life of critical bridges can be

accurately measured and predicted. As a part of the project, Savcor's **Futurtec OHM** monitoring system was installed in Kirjalansalmi Bridge.

When the SIMO project ended, VTT and the other participants decided to continue the research in a new project called **SITUEL**. The new project aimed to continue the research and develop practices and guidelines for the monitoring of Finnish bridges. During the SITUEL project, Savcor maintained and further developed the monitoring system installed in Kirjalansalmi Bridge.

- In the SITUEL project, the monitoring technologies developed by different systems suppliers were compared. In this comparison, our Futurtec OHM proved to be a highly reliable and functioning system. We developed OHM's user interface so suit the customer's needs and the system received a great deal of positive feedback, says Savcor's Division Manager **Pekka Toivola**.

At the end of the SITUEL project, the participants created monitoring instructions for Finnish bridges together with VTT.
- SIMO and SITUEL truly promoted the Finnish bridge monitoring, continues Toivola.

THE SMART BRIDGE PROJECT

When the SITUEL project ended in 2013, Savcor and the other participants began to think how the monitoring system and knowledge acquired in the past two projects could be further utilized.

- During the spring of 2014, we met several times with the representatives of VTT, **Finnish Transportation Agency** and **the Finnish Centre for Economic Development, Transport and the Environment ELY**. In these meetings, we discussed how to continue the development work Toivola says.

As a result of the meetings, the Finnish Transportation agency and ELY decided to start the third project named **Smart Bridge of Kirjalansalmi**. Savcor was given a role of the systems supplier and the Finnish Transportation Agency ordered a smart monitoring system from the company. The order is a three-year service contract and it includes extensive reporting, maintenance and a data server service. The service is based on the Internet of Things technology.

- Our central task in the project is to gather data and present it in an easily understandable format. The data gathered by our system includes all the indicators relevant to the life-cycle of Kirjalansalmi Bridge, explains Toivola.

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The system is developed as an internet-based service, because this allows the bridge to be monitored real-time, regardless of time and location.

TIMO TIRKKONEN

Project Manager, Finnish Transportation Agency



Photo: Liikennevirasto archive

INTERNET OF BRIDGES

- In this project, the Finnish Transportation Agency develops a real-time monitoring system to be used in the structural health monitoring of critical bridges together with Savcor and other service providers, says Project Manager **Timo Tirkkonen** of the Finnish Transportation Agency.

- The system is developed as an internet-based service, because this allows the bridge to be monitored real-time, regardless of time and location. Thus we can follow the condition of the bridge on a long term basis.

Savcor's Futurtec OHM system measures, records and reports the stress caused by the traffic and other factors every day around the clock. All the measured data can be accessed real time.

- We have equipped the bridge with measuring electronics, sensors, a camera, an embedded computer and software. Once a day, all the data gathered by the system is automatically transferred to the database located in Savcor's server, Toivola explains.

- The Finnish Transportation Agency can access the real-time information on the monitored bridge at any time. We don't need to send them separate reports, because all the information is available via an internet browser. The system can be accessed with a password regardless of time and place, and it can also be used with mobile devices, describes Toivola.

Savcor's monitoring system creates weekly, monthly and annual reports of the condition of the bridge in HTML and PDF formats. Additionally, the Finnish Transportation Agency and Savcor's experts can examine sensor-specific graphs including the minimums, maximums, standard deviations and other statistical information relevant to the durability of the bridge.

IMPORTANT PILOT PROJECT

During the past fifteen years, Savcor has delivered Futurtec OHM monitoring systems for the bridges around the world. However, as a comprehensive, internet-based service the monitoring of Kirjalansalmi Bridge represents a totally new concept.

- The monitoring of Kirjalansalmi Bridge serves as an important pilot project which allows Savcor to test a totally new service concept in practice, describes Toivola.

- We have developed a system, which is capable of recording and processing immense amounts of data, produce analysis rapidly and present the information in a clear and easily understandable way.

- In addition, the system indicates the number of events and possible deviations outside the limit values clearly with a single graph. Thanks to this, the client can easily make annual or monthly conclusions of the condition of the bridge. This valuable information helps them to predict the safe remaining service life of the bridge accurately.

According to Tirkkonen, the decision to renew or replace the bridge in the future will be made based on the information gathered by Savcor's monitoring system.

- The monitoring system has to be able to give us early warnings before the condition of the bridge reaches its critical stage. This will give us enough time to decide whether the bridge should be renewed or replaced. Thus, Savcor's system plays a key role in our decision making.

POTENTIAL EXPORT PRODUCT

Savcor's new service concept may be applied to new areas in the future.

- In the near future, we will go through new potential monitoring targets together with ELY. In the evaluation, our attention is focused on the sizes, carrying capacities and overall conditions of the bridges, says Tirkkonen.

He predicts that the monitoring system could also have potential as an export product.

- The future's application for the monitoring system developed could be an internet-based, standardized system to which different service providers could join. The technology developed in the Smart Bridge Project could also be easily modified to suit to the international markets. Savcor has served as an example of an exporter of the Finnish innovations already for decades. ■

KIRJALANSALMI BRIDGE

Completed in 1963, Kirjalansalmi Bridge is the longest suspension bridge in Finland. The length of the bridge is 287 meters and it is located between the cities of Kaarina and Parainen. Parainen is known for its heavy industry and the freight trucks crossing the bridge daily cause additional stress to the bridge. In the course of the decades, the traffic volumes and the weight of the trucks have increased. The planned remaining life cycle of the bridge is 15-20 years. This emphasizes the importance of the structural health monitoring during the remaining service life of the bridge.