



# The Computerworld Honors Program

Honoring those who use Information Technology to benefit society

## Final Copy of Case Study

YEAR:  
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STATUS:  
*Laureate*

**Organization:**  
NTT DATA

**Organization URL:**  
<http://www.nttdata.com/>

**Project Name:**  
Automatic Realtime Bridge Monitoring System (BRIMOS)

**What social/humanitarian issue was the project designed to address? What specific metrics did you use to measure the project's success?**

Highway bridges in Japan have suffered various kinds of damage, e.g., fatigue, corrosion, and abrasion, which have been worsened by the continual passing of overloaded heavy vehicles. There is a risk of a serious disaster in the event of an earthquake or accident occurring in the vicinity of bridges that are already weakened through damage. If such a disaster were to occur in a densely populated area such as Tokyo, the effects could be severe. According to seismic experts, there is a high risk of a big earthquake occurring in Japan in the immediate future. In such an event, the establishment of secure road networks is a key factor for ensuring public safety and preventing economic loss. One of the most important pieces of information required is whether vehicles, especially emergency and transport vehicles bringing in relief supplies, can pass over a particular bridge or not. However, getting this information generally takes several hours because it is done by someone checking at the location. Therefore, if a monitoring system could remotely check the integrity of several bridges instantaneously and simultaneously, it would substantially reduce both social and economic losses. The interval between regular inspections of Japanese highway bridges is typically five years, which is often not frequent enough for early detection of damage and, if necessary, appropriate maintenance scheduling. We are developing a bridge monitoring system (called BRIMOS) that is based on the use of advanced IT to automatically monitor bridge motion. This motion data enables road/bridge administrators to evaluate the status of a bridge. The system's various sensors, e.g., video cameras and optical

fibers, continuously monitor several of the bridge's daily motions and thus provide instant updates of unavailability caused by either abnormal loads, e.g., seismic ones, or routine loads.

**Please describe the technologies used and how those technologies were deployed in an innovative way. Also, please include any technical or other challenges that were overcome for the successful implementation of the project.**

Our system provides all the monitoring results for users in real time, and the user can get an instant alert if the results are abnormal. This system consists of four parts composed of six subsystems. The data collecting part at each monitoring site measures bridge motion using sensors and transmits the raw data to the information center. One of the key advantages of our monitoring system is the concentration of data processing and storage; i.e., we use a shared information system based on advanced IT. The information center covers a very wide area if the data transmission subsystem is between the sensor subsystem and the information center. The information center is constructed in a highly durable anti-seismic building equipped with several high-power generators. Our monitoring system meets three vital requirements for bridge management: disaster management, maintenance, and fatigue estimation. The first step was to design our monitoring plan on the basis of a previous study, which in turn was based mainly on data from the Great Hanshin-Awaji Earthquake (1995). A fault tree analysis is used for managing the response to a disaster and future maintenance. As fatigue is mainly induced by the live load of heavy vehicles, the weights, types, and number of vehicles are estimated. The next step, deciding how to deploy the sensor subsystem, was decided on the basis of the monitoring plan described above because it would have been too costly to deploy a range of sensors on all bridges in the area we investigated. Photographs of the different types of sensors are shown in Appendix 2; sensor attachment examples are schematically shown in Appendix 3. Only fiber-optic sensors are used because they have higher durability and because they do not use electricity.

**Please list the specific humanitarian benefits the project has yielded so far.**

Since deploying the BRIMOS application, NTT DATA has been able to identify bridge problems more promptly. The potential tragedy and loss of lives is great, so it's important to know that the country is doing all that it can to ensure motorist safety.

**Please provide the best example of how the project has benefited a specific individual, enterprise or organization. Feel free to include personal quotes from individuals who have directly benefited from the work.**

During most recent natural disasters, the establishment of secure road networks is a key factor for ensuring public safety and preventing economic loss. One of the most important pieces of information required is whether vehicles, especially emergency and transport vehicles bringing in relief supplies, can pass over a particular bridge or not. BRIMOS is able to provide vital data to ensure the resources are able to get to the proper areas safely and effectively. The monitoring system is keeping the citizens of Japan safe by understanding the bridges that are not safe to cross. It also ensures that the country is able to repair damaged bridges before a disaster occurs. With the frequent earthquakes and highly populated cities, it is immeasurably important to ensure the thousands who cross the bridges each day are safe.