A magnetic anisotropy sensor is used for nondestructive measurement of stress on surfaces of H-beams used as structural elements in tunnel support systems. The sensor is built on the principle of the magnetostrictive effect in which changes in magnetic permeability due to deformation of a ferromagnetic material, such as steel, are measured and converted to absolute values of stresses existing on the surface of the material. Proper treatment of boundary conditions allows determination of stress tensor completely on surface of H-beam flanges, with average error of 10 to 20 MPa.

A series of stress measurement was conducted for H-beams in NATM tunnels. The results obtained from the field stress measurement were in full accordance with the findings made from the previous series of measurement in a lab. The sensor used in this study is small, easy to carry around even into a tunnel, for example, and allows direct, nondestructive measurement of absolute values of stresses on surface of steel.

The use of this sensor is not limited to H-beams and it can be applied in any situation where surfaces of steel, in the forms of beams, plates, pipes, walls, etc. are exposed for human access. Not only a direct use of the results of stress measurement is beneficial in numerous civil and mining engineering applications, but also a secondary use of the information for interpretation of deformational behavior of structures in concern, in this case a tunnel, is also possible.

A case study for evaluation of axial force in ground anchor is also introduced. With a unique characteristics of the magnetic sensor for stress reading during plastic deformation, a novel method is briefly discussed for estimation of the maximum load exerted on a steel product in the past.

For more information, contact Professor S. Akutagawa of Kobe University, Japan.

E-mail: cadax@kobe-u.ac.jp
Find out what these lights are for and how these can be used to improve safety and reduce risk in your project!

Join the seminar #2 by Visiting Professor S. Akutagawa (Kobe University, Japan).
“On Site Visualization” for Risk Visualization and Management for General Monitoring and Minimization of Natural Disasters

14:00 to 17:00 on September 21st, 2012
Room GCD0386

“Safety First” is the concept and the slogan shared by all, required for all, but difficult to achieve throughout the world. Construction sites are full of dangers. Workers are exposed to various kinds of “Unexpected Accidents” that threaten their lives, delay construction and make owners to pay more.

Monitoring is, therefore, necessary. We know that for many years. We need to keep our eyes on structural behaviors during construction to confirm that everything is all right. But when things really go wrong, such as too much force in strut beams, too much inclination in retaining walls, etc., it is not easy to follow those behaviors real-time, because the information from the monitoring usually does not come to you when they happen. That is brought to you after some analysis or processing is made. If the situation is really serious, there is no time to do this, but the bad signal must be given to workers with no delay in time to let them know the danger.

This is why we need “On Site Visualization”. Employment of the OSV monitoring method enables real-time data processing and visualization on-site, so that the state of deformation, strain, inclination, earth pressure etc. for the structures in concern can be grasped with no delay in time and is shown visually to anyone nearby. Rationally designed use of this method could give us early warning signs, if any, and minimize risks not only during construction of underground infrastructures but also during their service time. On Site Visualization, once embodied in the framework of safety management practices, could lead to a better and quick understanding of potential risks and improved management of safety at construction sites. It is also obvious that the concept can be applied to natural disaster mitigation.

In addition, the employment of OSV necessitates a new form of collaboration between engineers and citizens. As visualized information can be shared by all who have direct visual access to these lights, a new set of rules need to be made to win safety for all concerned. The seminar covers early developments, application cases in Japan and India, and future insights for even more economical way of performing OSV monitoring with low cost devices.

For more information, contact Professor S. Akutagawa of Kobe University, Japan.

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