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WHEN MEASUREMENTS MATTER

CASE STUDY

Lakhta Tower: Campbell Systems Provide Critical Data

SUMMARY

Problem:
Good quality data was vital for the construction of Europe's tallest skyscraper. The complex project required a system able to measure over a thousand strain gauges.

Solution:
SODIS Lab used Campbell Scientific data loggers and peripherals, integrated by MonSol, to deploy a series of strain monitoring systems. This was a critical element for the construction of the Lakhta Tower.

Realised benefits:
Campbell-based data-acquisition systems provided excellent data during construction and for ongoing structural monitoring.

Location:
Lakhta Center, Saint-Petersburg, Russia

Customer:
sodis lab MONSOL

CAMPBELL-BASED SYSTEMS PROVIDE EXCELLENT DATA FOR CONSTRUCTION AND MONITORING OF EUROPE'S TALLEST TOWER

Campbell Scientific-based data acquisitions provided excellent quality data during the construction of the Lakhta Tower and were able to handle a large amount of sensors. The versatility of our data loggers and vibrating-wire (VW) interfaces made it easy to integrate geotechnical equipment into the strain monitoring systems. Vibrating-wire spectral-analysis technology (VSPECT™) provided great immunity to external noise sources.

The solution significantly reduced the length of cable lines and the likelihood of cable damage during construction. Repairs were simplified and more cost effective, allowing cable routing to be quickly changed and the need to splice strain gauge cables was eliminated. Furthermore, the integration of instrumentation installed during construction into the building management system (BMS) provided the important function of ongoing structural monitoring.

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DELIVERING DATA – EUROPE'S TALLEST SKYSCRAPER

Problem

The Lakhta Tower is a building that was completed in 2018, designed for both social and business use on the shores of the gulf of Finland. Currently the tallest skyscraper in Europe at 462 metres, it was critical to get good quality data before, during, and after the construction process.

The data-acquisition system had to be fully automated and able to send data to the contractor's office. The box foundation strain monitoring system is the most ambitious and complex subsystem within the structural health monitoring of the tower. It was designed to analyse changes in the foundation's stress-strain state, which was in the Guinness World Records 2015 as the world's biggest reinforced concrete structure (19.6 thousand cubic metres). Due to the complexity of the project and engineering challenges involved, a system able to measure over a thousand strain gauges was required.

The Solution: SODIS Lab and MonSol

SODIS Lab was responsible for the design and deployment of the strain gauge monitoring systems. The deployment of these systems was divided into six stages. They built the data collection nodes using Campbell Scientific data loggers and peripherals. Communication between the nodes was provided via a temporary wired data network. The data collection stations included CR1000 dataloggers and AVW200 VW interfaces. Multiplexer enclosures were installed directly above every outlet point of the signal cables. This solution significantly reduced the length of cable lines, reduced the likelihood of cable damage during construction, simplified repairs, allowed cable routing to be changed quickly, and eliminated the need to splice strain gauge cables.

For their VW sensor-based monitoring, SODIS chose to work with Monitoring Solutions (MonSol) who, at the time of this project, had been providing Campbell-based VW and VSPECT™ solutions in Russia for many years. Functioning as a subcontractor to SODIS, MonSol not only supplied Campbell instruments, but did so at the integrated-systems level by providing the data-collection platform.

For more information, the full paper on the project by SODIS Lab can be found here:
http://sodislab.com/_editorFiles/Lakhta_paper_dec2018_eng.pdf .

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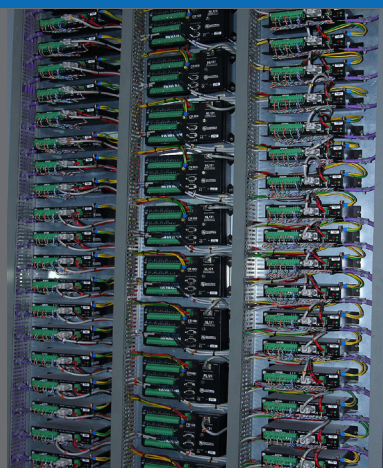

About the System

The CR1000 can be used in a broad range of measurement and control functions. Rugged enough for extreme conditions and reliable enough for remote environments, it is also robust enough for complex configurations. Used in applications all over the world, it is a powerful core component for data-acquisition systems.

The AVW200 is a VW analyser module that allows our data loggers to measure VW strain gauges, pressure transducers, piezometers, tiltmeters, crackmeters, and load cells. These sensors are used in a wide variety of structural, hydrological, and geotechnical applications because of their stability, accuracy, and durability. Using VSPECT™, the AVW200 provides better measurements by significantly reducing incorrect readings caused by noise sources.

Benefits of VW-Based Systems

A long service life of at least ten years after construction was required for the system. The standard for long-term monitoring of slowly varying strains in building structures is VW technology. VW gauges can operate for decades and demonstrate excellent zero stability. The advantage of VW technology is the type of signal—the natural vibration frequency of the tensioned wire. This signal is easily transmitted without distortion over long distances. It is not susceptible to corrosion or moisture on the cable line conductors, only slightly sensitive to electromagnetic interference, and does not depend on cable length.

Deliverables

Campbell Scientific-based data acquisitions provided excellent quality data during the project and were able to handle a large amount of sensors. The versatility of the data loggers and VW interfaces made it easy to integrate geotechnical equipment into the strain monitoring systems. VSPECT™ technology provided great immunity to external noise sources.

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