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Structural Health Monitoring System for The Queensferry Crossing

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Abstract

The Structural Health Monitoring System (SHMS) for the new Queensferry Crossing cable stayed bridge, Scotland include more than 1500 sensors combined to yield a world leading SHMS for data driven asset management making use of the latests technologies in data processesing and data warehousing.

Keywords: SHMS, Software, Data aquisition, Data processing, Cable stayed bridges

1 Introduction

This paper describes the design, implementation and potential benefits of the state-of-the-art Structural Health Monitoring System (SHMS) for the recently completed Queensferry Crossing road bridge in Scotland, which at is at 2.7 kilometer the longest triple-tower cable-stayed bridge in the world with two main spans of 650 m each.

The bridge was designed a joint venture between Ramboll, LAP and Sweco. In a joint effort between Ramboll and Strainstall, the SHMS for the Queensferry Crossing has been designed and implemented to be world leading both in terms of scale and benefits to be drawn from the system, with the aim of providing diagnostic and prognostic analysis of the global structural system and local structural component by advanced structural analytical techniques, hence using multiple options for monitoring the structural health of the bridge.

More than 1500 sensors combined have been installed on the bridge in addition to an elaborate system of data processing, operation and

management facilities. The purpose of the SHMS is to take proactive measures at an optimal time to avoid that a situation becomes critical and hence to prevent damage development from such occurring situations. Through focused sampling and conditioning of data originating from critical elements of bridge, the SHMS will be an integral part of a data driven asset management system which aids prioritizing and planning of inspection and maintenance programs.

2 Hardware design

The data acquisition system for the Structural Health Monitoring System (SHMS) is designed to be a modular structure and is separate from the data processing systems running on the server. The network backbone of the SMHS is provided by a fiber optic loop which runs the entire length of the bridge structure and is continued via the server in the South Abutment to the server in the bridge office some 4 km away.

The SHMS acquisition system is based upon the National Instruments PXI and cRIO data acquisition