Additionally Selected Technologies
Priority, Market-Ready Technologies and Innovations

2007

Embedded Data Collector

The Challenge:

Better Bridge Management.

Structural failure is a terrible reality. As States across the nation inspect their bridge inventory to determine maintenance and rehabilitation needs, non-quantitative and highly variable data obtained from current inspection programs often prove inadequate for making comprehensive, long-term life-cycle and bridge management decisions.

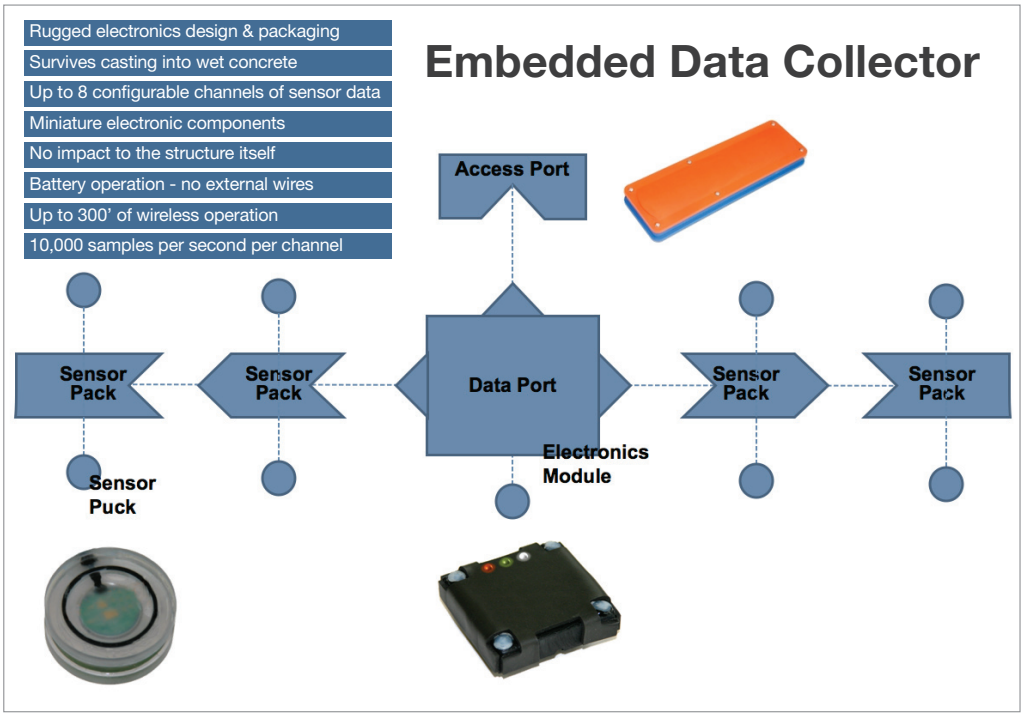
Developing a technically viable, cost-effective alternative to conventional load testing will enable decision makers to select the optimal course of action both now and into the future.

The Solution:

Embedded Data Collector
Embedded data collectors enable state transportation agencies and design-build firms across the nation design, test and construct better foundations for buildings and bridges, enhancing efficiency and improving structure quality.

How Does Embedded Data Collector Work?

The embedded data collector (EDC) collects, transmits and processes information from driven concrete piles. Through sensors embedded in the pile the EDC measures the pre-stress cast into the pile, providing accurate warnings if the pile is subjected to potentially catastrophic tensile stresses.



Putting It In Perspective

Data Acquisition Systems and Analysis Software are Complicated and Require Highly Experienced Users

Expensive Gauges are Attached Post-Installation to Pile Leads that Must be Detached Prior to Lead Removal

Someone Must Climb the Leads to Attach and Detach Gauges

Current Technology Provides Unreliable Estimate of Pile Toe Capacity

Analysis Software Does Not Provide a Unique Solution

Multiple embedded sensors provide tip resistance as well as shaft and ultimate resistance or capacity. To enhance safety and ease of use, EDC design allows monitoring and recording of data from up to 300 feet from the pile, with no wires to connect. PC-based software generates DOT-formatted reports, provides multi-user access with password control and provides views to data from both current and past projects.

Successful Application:

Woodrow Wilson Bridge Replacement, Washington, DC

In cooperation with the Virginia Department of Transportation (VDOT), the Federal Highway Administration (FHWA) is conducting a pilot project that uses structural health-monitoring (SHM) sensing technology. The goal of this project is to develop a comprehensive research plan for substructure SHM needs as well as guidelines for a "smart bridge" monitoring system.

The field project is evaluating whether an off-the-shelf instrumentation system designed for pile installation monitoring can also be used for long-term substructure health monitoring. SmartPile, the monitoring system developed by researchers at the University of Florida, has been installed on pre-stressed concrete foundation piles approximately 57 feet long.

The system consists of two strain gauges and two accelerometers placed two diameters below the top of the pile and at the tip of the pile. Strain and acceleration data is collected in the concrete piles and caps. Signals are transmitted by cable to a receiver and transmitter, and then wirelessly to a workstation, where data reduction and analysis are performed in real time. Data is collected on a configurable schedule and relayed via the Internet using an unmanned SmartPile Gateway device.

An instrumented concrete pile and cap at the Woodrow Wilson Bridge outside of Washington, DC. The instrumentation system is collecting strain and acceleration data

Installation and data collection began in 2006, with positive results to date. Monitoring will continue for 25-30 months.

Additional Resources

Further information about Embedded Data Collector technology is available **here**

Embedded Data Collector Piles

Estimation of Pile Tip and Skin Capacities in Real Time

FOCUS, FHWA, 2006

A New Approach to Monitoring Bridge Substructure Health

Smart Structures

Smartstructures

Benefits

Reduced Job Site Injuries to Inspection Personnel

Embedded Strain and Acceleration and Real Time Tip Measurements

Static Testing

Reliability

Better Capacity Estimates

Time Savings at the Project Site

Contacts

David Sadler
Florida DOT
(850) 414-5203
David.Sadler@dot.state.fl.us

Carl Ealy
Federal Highway Administration
Carl.Ealy@fhwa.dot.gov

Tom Chiarella
Smart Structures, Inc.
(408) 306-5700
tc@smart-structure-inc.com