

## C3-Match Series

# Concrete Curing Box System

### *Control curing boxes remotely and automatically*

Engineering projects require increasingly stringent control over the quality of work and materials. High Performance Concrete (HPC), exceptional working conditions and the weather are all moving pieces in the concrete quality control puzzle. GEO-Instruments' C3-Match Series system solves many of the challenges associated with the production of concrete cylinders by offering fully automated wireless control from sensors installed within the concrete forms.

This unique system can:

- Cure concrete cylinders in a location that is protected from the elements
- Allow real-time production of concrete cylinders that comply with the strictest standards
- Enable real-time temperature monitoring and generate alarms if predefined thresholds are exceeded
- Combine structural health monitoring with concrete quality control measurements.



C3-Match Series

## Why use the C3-Match Series system?

The most common curing boxes are adjusted manually by operators on the basis of manual or laboratory readings without precise knowledge of field conditions, which adds uncertainty to the maturity curve of the cylinders. Manual control is not compatible with modern projects that require a high degree of accuracy in the characterization of materials. Where higher quality samples are required, automated curing boxes are usually controlled by thermocouples embedded directly in the concrete structure. The C3-Match Series system makes it possible to relocate the boxes to the most appropriate location.

## How does the C3-Match Series system work?

The C3-Match Series system has several key components. Embedded temperature sensors are read automatically by a battery powered data logging system, which can then relay the readings over long distances to a gateway. The gateway can be either hooked up to the Internet or used locally to control the temperature of the curing boxes.

The C3-Match Series system can be enhanced by GEO-Instruments' cloud computing tools, which offer a high degree of flexibility for real-time data visualization by everyone involved, to generate specialized calculations or to facilitate storage for long-term monitoring.

## Example applications

### ■ Mine and tunneling shafts

Because shafts are vertical structures, curing boxes cannot be used next to the concrete structure. The C3-Match Series system allows the boxes to be deployed either on the surface or in the laboratory where the materials are tested.

### ■ Tunnels

Tunnels typically are narrow, which limits the space available to work in and for the installation of long-term curing boxes. In addition, health and safety concerns may limit workers' access to the boxes to collect concrete cylinders. These constraints are entirely avoided by installing the curing boxes at the mouth of the tunnel.

### ■ Bridges

The construction of bridge piers is an ideal type of project for remote wireless monitoring and control, as water significantly limits the mobility of workers who must take manual readings or collect samples.

### Internet connectivity

The C3-Match Series system can be complemented by the addition of data plans that can collect the data obtained remotely through the gateway and control the curing boxes in other locations, for example in the laboratory or at the concrete plant.

### HMI (Human-machine interface)

The addition of a Human-machine interface (display panel) allows on-site operators to view the current state of the system and the curing boxes in a single location by means of visual indicators.

### Cloud computing tools

GEO-Instruments' advanced cloud computing platform offers remote data visualization, alarm generation via email and centralized data hosting.

These tools can also be used to calculate values such as temperature gradients within the concrete, the maximum temperature reached by any of the sensors or the concrete maturity curve.

### Structural health monitoring

The C3-Match Series system can be used in conjunction with a structural health monitoring system—such as embedded strain gauges (Geokon model 4000), total pressure cells (Geokon model 4800) and concrete stressmeters (Geokon model 4370)—based on the LS Series for a complete picture of the structure's behaviour.

## Technical data

### Radio range of data loggers

15 km

### Battery life of data loggers

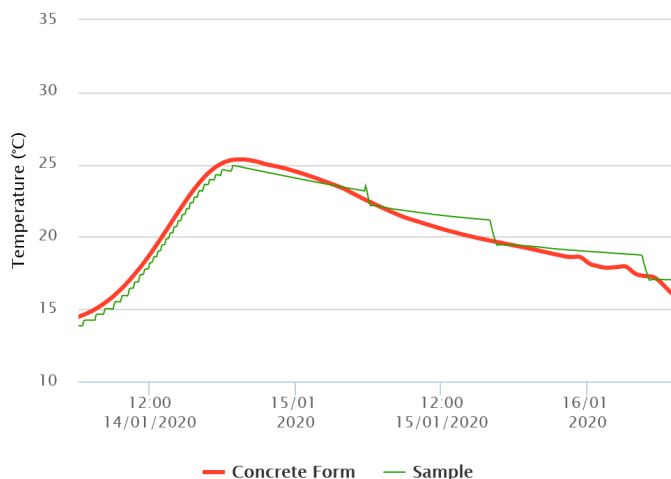
10 years

### Temperature update rate of the curing boxes

every 30 minutes

### Maximum temperature difference between the curing box and the reference sensor

2 °C



Temperature control of concrete samples in a laboratory located 3 km from the construction site.