

CROSSHOLE SONIC LOGGING - CSL

Integrity testing of concrete piles by ultrasonic crosshole logging

Variations in the concrete in deep foundation piles and concrete walls can be determined by using a crosshole sonic logging system.



Prompted by industry demand for a method to test the structural integrity of concrete in foundation piles Rambøll has invested in the SCXT3000 crosshole sonic logging system developed by Testconsult Equipment.

Hardware

The crosshole sonic logging system consists of a rugged notebook used as logging unit, an electronic winch unit and two ultra-sonic transducers. This simple system makes it very easy to transport

and setup even in locations with limited access.

The logging unit is a rugged notebook that handles all the incoming data. Furthermore, the logging unit supplies the entire system with power for up to 8 hours. If more is needed the system can run on external power from either a car charger or generator.

The electronic winch unit displays depth, amplitude and profile reference. From the winch it is possible to reset depth and change profile reference for fast operation.



The transducers consist of a 25 mm diameter piezo ceramic emitter probe and a 25 mm diameter receiver probe. These transducers are connected to an emitter and a receiver cable, accordingly.

Software

The intuitive software enables the production of complete pile data sheets which show references to tube top level, tube toe level, calculated tube lengths, tested lengths of each profile, pile cut-off level, pile toe level and the complete profiles of each test including first arrival time and energy. On these profiles it is possible to add potential changes in first arrival time. This visualizes in an easy way the proportions of any defects.



If all pile data is supplied prior to the site visit a first impression of the acquired data can be assessed and discussed with the client on site.

Crosshole Sonic Logging (SCXT3000) specifications:

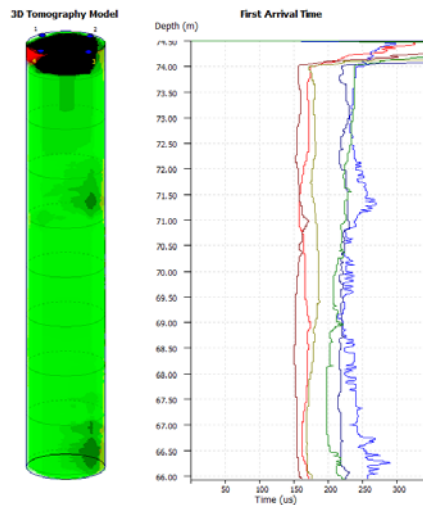
- **Ultrasonic frequency: 50-60 KHz**
- **Signal measurement for every 1-2 cm depth**
- **Calculation of First Arrival Time (FAT) and Energy changes**
- **Measures concrete piles up to 150 m**
- **Time base 200 to 1000 μ sec**
- **Path length up to 3 m in hardened concrete**
- **2D & 3D tomography**
- **Strengths: A strong tool for quick assessment of deep concrete foundation piles and concrete walls.**
- **Weaknesses: Requires tubes (Steel preferred) installed in piles and walls**

The CSL methods

The transit time of sound in concrete is measured using ultrasonic transducers. The transducers are lowered into the steel (preferred) tubes installed in the concrete piles. The transducers are aligned for best signal before start of test. The cables are placed over the electronic winch which is reset to depth zero and the desired profile.

When the measurement is commenced the cables are manually pulled over the winch. As the winch turns the emitter probe sends a signal for every 1-2 cm which is stored in the logging unit. In the logging unit the traces are compiled into a combined profile. This sequence is repeated for all possible tube combinations. If a pile consists of four tubes there are six combinations. These six profiles are shown as waterfall plots in the software program where it is possible to manually or automatically select threshold levels for optimization of first arrival time. The profiles can be shown together enabling a differentiation between features like tube debonding or true concrete defects.

The software contains a 2D & 3D tomography module which provide a visual change in first arrival time and energy throughout the concrete pile.



Based on the collected data Rambøll performs a thorough interpretation of each pile. This is gathered in a complete report where all interpretations are highlighted in text in addition to the interpreted individual profiles.

Besides the crosshole sonic logging system Rambøll offers many other kinds of geophysical methods and survey opportunities.

Please contact us for references on this system and questions about other services. We will be pleased to guide clients to the best possible survey programs whether it may be piles, walls, geophysical borehole logging, or subsurface measurements such as MEP, TEM, 2D & 3D georadar, reflection and refraction seismics or cable tracking – both onshore and offshore.

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