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MAGAZINE North American Acceptance of Self-Consolidating Concrete: A Diffusion of Innovations Perspective **CONCRETE TECHNOLOGY** Density measurement in concrete residual water **REINFORCEMENT TECHNOLOGY** New CNC wire and Rebar bending machines

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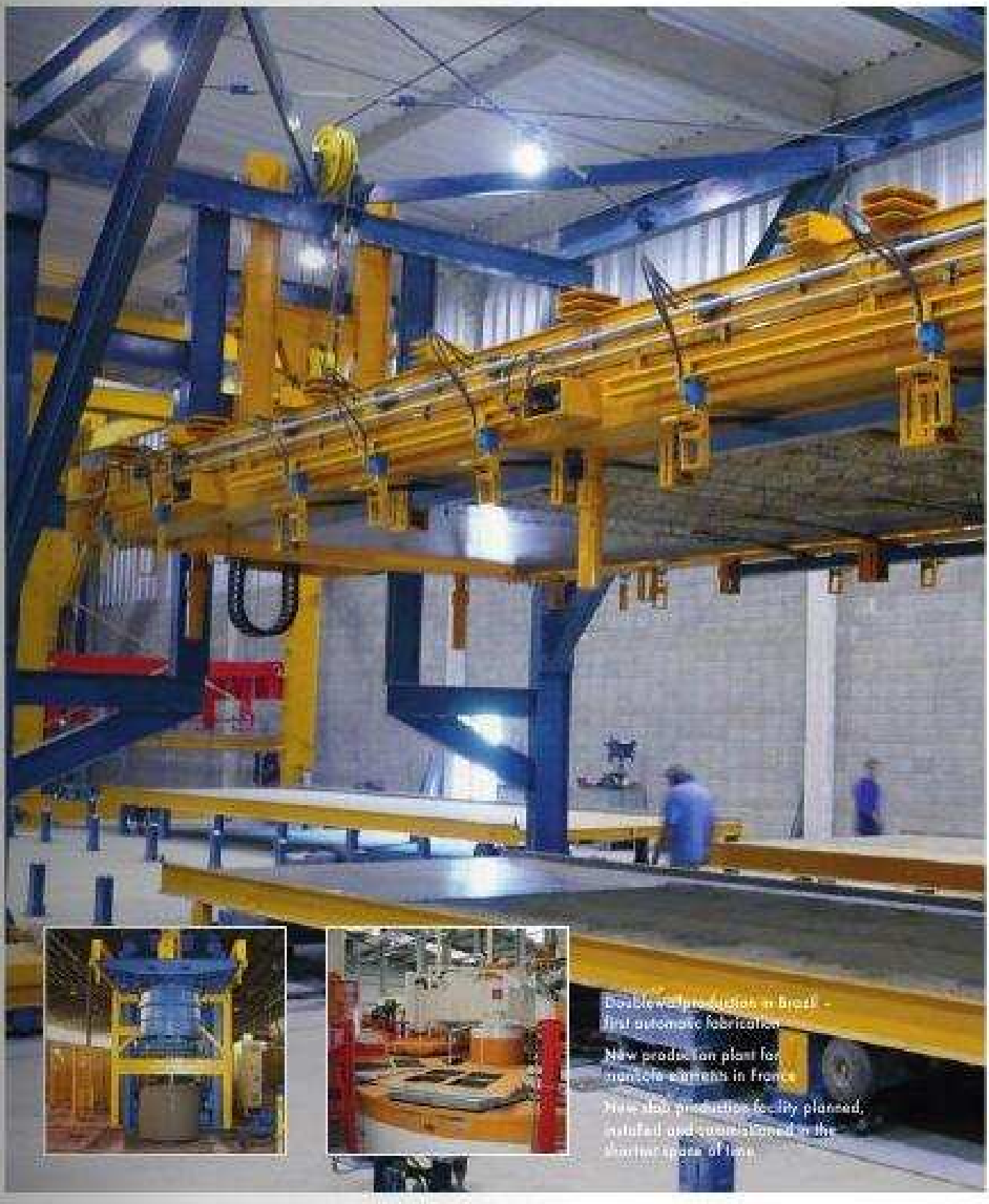


Double-wall production in Brest – first automatic fabrication

New production plant for concrete elements in France

New slab production facility planned, installed and commissioned in the shortest space of time

Werne & Thiel sensortechnic, 79793 Wutöschingen, Germany

Density measurement in concrete residual water

Around 40 million cbm of ready mix concrete are currently produced annually in Germany. Normally, around 2 to 3 % of that cannot be processed. This residual mass of concrete comes, for example, from concrete that the customer didn't purchase, or from concrete that adheres to the inner wall of the drum of the mixer truck after delivery. If this residual concrete mass cannot be recycled, it has to be disposed of at great cost as special waste.
The ready mix concrete industry has been making efforts for many years to make the transition from a pure disposal technology to a material management system in closed material circulations. However, this necessitates new measuring systems and new technologies. The company 'Werne & Thiel sensortechnic' has taken up this challenge and, in the 'OLAS measuring system' (Optical Light Absorption Sensor), has developed a revolutionary online measurement method for determining the density of concrete recycling water.

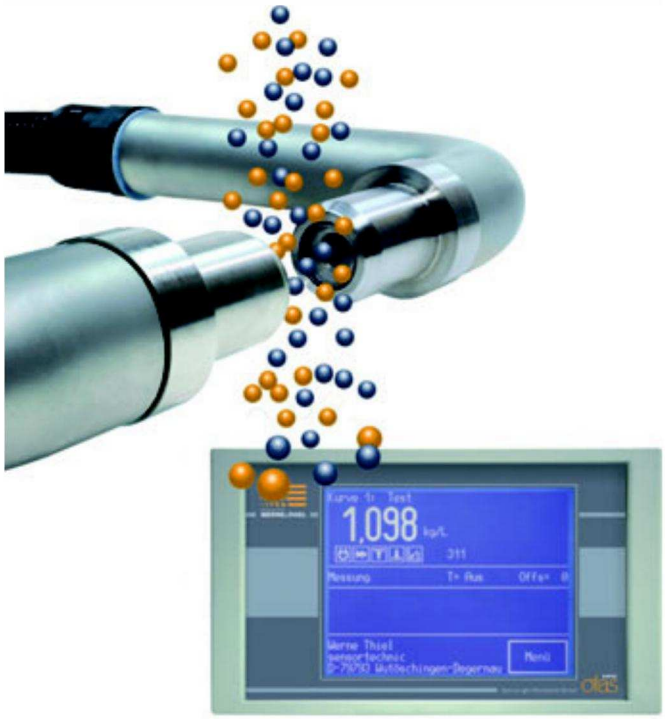
The former 'Arnold Automation' company – known as a pioneer of moisture measuring systems in concrete production – was taken over by Werne & Thiel sensortechnic in 2002. Alongside the continuing further development of the proven Arnold moisture measuring probes, the new owners are specialised in the development of innovative industrial sensor technology.

The development of the OLAS measuring system, an online measuring system for determining the solids content of concrete recycling water, began almost ten years ago. Today, a reliable and economic measuring system is available that has reached series production maturity.
The OLAS is named after its function: 'Optical Light Absorption Sensor'. The OLAS makes use of a sophisticated infrared absorption measuring method, in which the measurement light is introduced into the medium via optical fibres. If desired, the OLAS can be supplemented by the OLAS-TPC (OLAS Touch Panel Controller), an optimal evaluation, display and control unit, to form a complete measurement system.

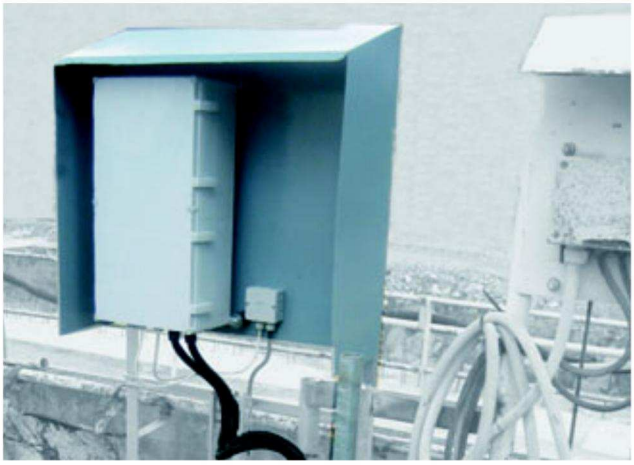
Holcim Kies und Beton AG's concrete plant in Diessenhofen, Switzerland

Requirements and characteristics

For a closed material circulation in concrete production, EN08 requires that the density in the residual water tank does not exceed the limit value of 1.07 kg/l. The standard measurement range of the OLAS lies between 1.000 kg/l and 1.150 kg/l and therefore exceeds the required range by far. It is therefore possible to measure the maximum density value reliably and to lower it again by adding fresh water, even if the limit value is only exceeded briefly.
With this worldwide patented development it is now possible to significantly improve concrete quality through the automatic and continuous measurement of the density of the concrete recycling water. The results of extensive long-term tests with the first series-produced OLAS measuring system devices are now available:
An OLAS measuring system was put into operation at Holcim Kies und Beton AG in Diessenhofen (Switzerland) as early as November 2007 for the monitoring of residual water density. Works Manager Florian Mascherin's verdict following one year of daily use: "Thanks to the measuring device and the digital display of the residual water density, we are informed of the current density in the residual water tank at all times. We can integrate the value directly in the production controller. As a result of that, the quality and, in particular, the constancy of the values from the lot protocol and the fresh concrete check have improved significantly. The measuring system is virtually maintenance-free and the display provides us with highly accurate measured values."



OLAS measurement principle and OLAS touch panel control

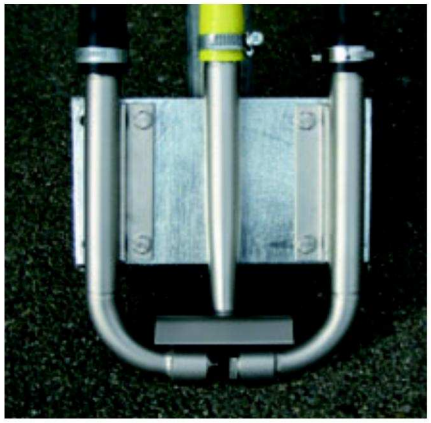


Measuring circuitry in the protective enclosure mounted on the rim of the residual water tank

Successful tests in practice

In summer 2008, the OLAS measuring system was integrated in controllers made by Domer Electronic on several concrete plants in the Freiburg area. In summing up, the Works Manager and those responsible praise the precision of the measurement, the reliability of the OLAS measuring system with respect to cleanliness and service, the daily saving of time and the easy handling. Other users confirm that the OLAS measuring system is a well thought out, innovative and flexible measuring system that can make a decisive contribution towards ensuring high concrete quality when using concrete recycling water in concrete production.

An excerpt from the technical details for this measuring system shows the innovative approach of this development. The device has a settling time of less than 40 msec and can reliably measure and display measurement light intensities of 1/10,000,000 of the maximum intensity. The internal resolution of the OLAS measuring system is even higher. Especially in the case of highly dense media such as concrete recycling water, the penetration of the measurement light is enormous and the OLAS measuring system can play to its strengths.



Measuring head with protected optical fibre cable and 'null method' control unit.

System structure

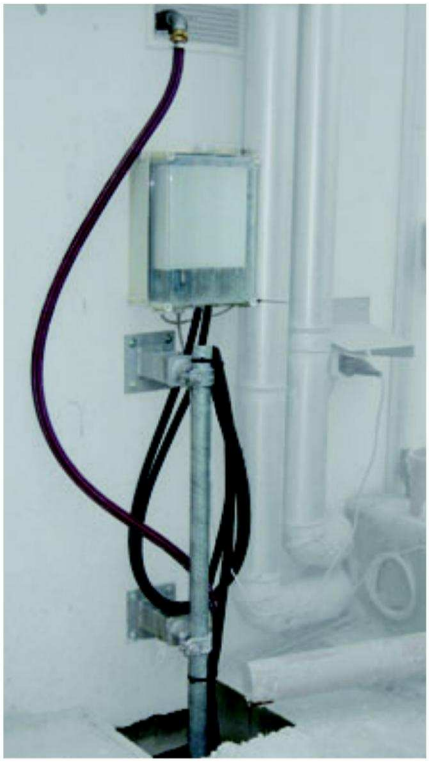
The OLAS measuring system consists of a measuring unit, the actual OLAS and a display and control unit, the OLAS Touch Panel Controller (OLASTPC). The two units are linked to each other via an RS485 interface. This means that the measuring unit can be placed at a distance from the display and control unit. However, the OLAS can also be directly connected to the process controller, either via the said RS485 interface or via an optional 4-20 mA interface.

Two optical fibre cables up to 20 m long and enclosed in a protective sheath are fed from the measuring unit (OLAS) to the measurement point. One of the optical fibre cables is connected to the optical transmitter, the other to the receiver. Both cables finally open out into the sensor head, which is immersed in the recycling water at a suitable position. Due to the use of an optical fibre system, the measuring head contains no circuitry at all and is therefore completely insensitive to electromagnetic interference. Since no consideration needs to be taken of bulky circuitry, the measuring head can also be constructed so that it is very compact and space-saving and is particularly easy to install.

Thanks to this arrangement, the sensitive measuring circuitry is located outside the measured medium and well away from three-phase appliances that cause interference (pumps, agitator motors), making the measuring system permanently robust and extremely insensitive to interference. By means of positioning the measuring head in the suction area of the pump, the OLAS always measures the actual density of the residual water that is fed to production.
In addition, the OLAS features a unique external light suppression system. Not only is 'constant light' (sunlight etc.) suppressed, but also changing light components, such as the light from fluorescent tubes. The high degree of suppression of external light means that optical screens can be dispensed with.

The evaluation and display unit (OLAS-TPC) is similarly a new development. Operation takes place via a touch screen. The large LCD graphic monitor makes operation simple and straightforward. A calibration curve is entered using a teach-in procedure. It is possible to enter up to 8 different calibration curves, each with up to 40 calibration points. The calibration curves can be displayed and edited graphically or in tabular form. A chart recorder mode can also be selected, which allows the measured signal to be displayed as if on a transient recorder. An external PT100 temperature sensor can be connected to the evaluation and display unit if desired, allowing the temperature of the measured medium to be displayed. The evaluation and display unit features all known standard signal outputs.
The calibration of the measuring system is very simple. First of all, several different samples are prepared in a density range of, say, 1.000 to 1.150 kg/l, whereby the sample for the zero compensation should be clear water. The OLAS-TPC's semi-automatic calibration procedure now enables the calibration points to be entered directly in a simple fashion. To this end, the measuring head is immersed in the first sample, the measured value is saved automatically and the reference density value determined by means of an areometer is entered immediately afterwards. This procedure is then repeated for the other samples. The OLAS-TPC calculates the calibration curve fully

Immersion of the measuring head in the residual water tank



Installed OLAS measuring system

Calibration of the OLAS using the prepared samples

Determination of the density of samples using an areometer

automatically from the calibration points using linear interpolation. In this manner, the complete calibration curve with all calibration points can be entered in a matter of minutes!

Following this calibration, the OLAS measuring system is ready for operation and displays the correct density in kg/l. The measured value thus linearised can now be relayed directly to a process controller.

Calibration process

The accuracy of the measurement can be checked at any time during operation, if desired, by means of a manual or automatic cyclic null method test. To this end, clear water is simply injected at high pressure between the transmitter and receiver unit and the measured signal is compared to the zero compensation. Any foreign body trapped in the measuring beam of the optics would be detected immediately in this manner. Conversely, the water jet can, of course, be used to cleanse the optics of foreign bodies and deposits.

The OLAS-TPC takes over the complete control of the water jet for the zero test, including extracting the zero test measured value from any signal averaging procedure that may currently be in progress.

Unique

As opposed to classic turbidimeters, which also function optically, dirt or scratches (due to an abrasive measured medium) on the optics hardly have any effect on the measurement accuracy in the OLAS. The reason for this is that turbidimeters normally work in such transparent measured media that scratches on the optics absorb considerably more measurement light than the measured medium itself. In the case for which the OLAS was conceived, this is totally the opposite. In this case, the measured medium absorbs considerably more than the dirt or scratches on the optics!
In order to also be able to rule out influences on the measurement accuracy due to scratches in much clearer measured media, 'pre-aged' optics are available for the OLAS on request. ■

FURTHER INFORMATION

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