



Vikasonic - Measuring the Early Setting and Hardening with Ultrasonic Waves

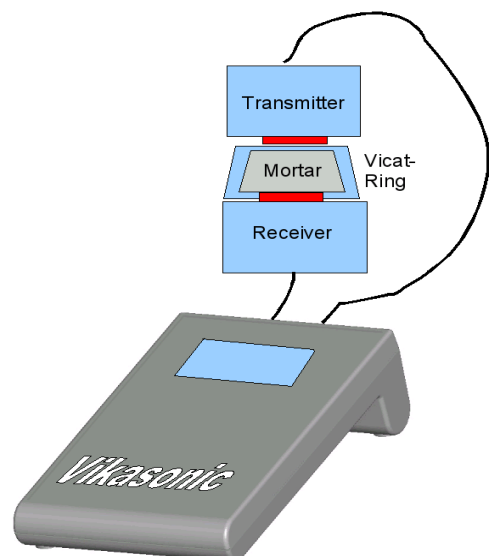
The early setting is usual measured with the penetrometer or the Vicat apparatus. This kind of measurement has some disadvantages. In the early sixties some researchers suggested to use the ultrasonic transition time as method for measuring the setting of mortars or fresh concrete. In cooperation with a German dry mix company, Schleibinger developed a special ultrasonic unit with an integrated datalogger and a special designed setup for the mortar specimen.

Measurement Principle

Fresh mortar is setting between two ultrasonic transducers, which are supplied with 0.25s or less pulses per second at a frequency of 54 kHz. The mortar changes, according to the setting, the ultrasonic transition time. From the beginning of first contact of the growing binder-stone, the ultrasonic sound speed increases. If there is a complete crystalline structure the change of the sound speed will be slower. Until the a further aggregation of the cement stone it increases again.

Measurement Setup

Each measurement cell is supplied with a pair of ultrasonic transducers. The **Vikasonic** continuously measures the ultrasonic transition time and the signal damping. The data sets are recorded digitally to a common USB stick. Also the sound speed and the elastic modulus is calculated and recorded. Additionally the temperature inside the specimen is measured with a type K thermocouple. The Schleibinger **Vikasonic** is an autonomous instrument, during the tests no PC is required. The data may be directly imported into your Excel worksheet. The software was de-



veloped at Schleibinger and may be adapted to your special requirements.

Application Example

Dr. B. Gerstner and F. Richartz (former Hasit central lab www.hasit.de) made some tests to compare the Vicat and the ultrasonic method.

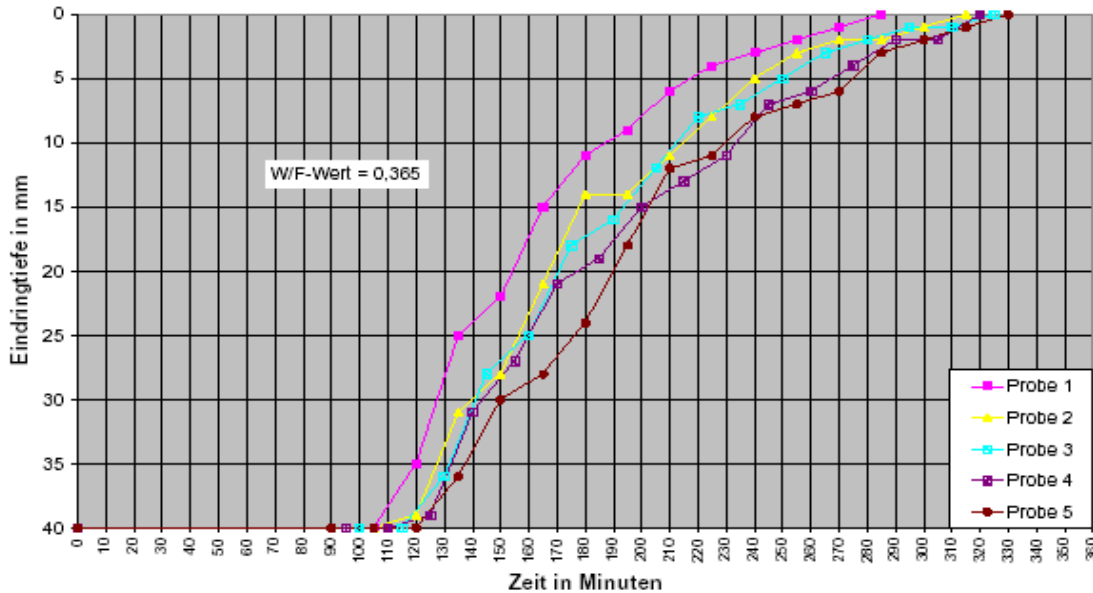


Bild 1: Reproduzierbarkeitsuntersuchungen zum Abbinden von Kalk-Gips-Putz 150 (Kissing) mit dem Abbindekonus

Penetration depth in mm over time in minutes - 5 times measured with same material and the same water/binder ratio

Tests with the Vicat Apparatus

With the Vicat apparatus the deviation in percent depends on the penetration depth. With this tests the deviation range was from 27% to 40%.

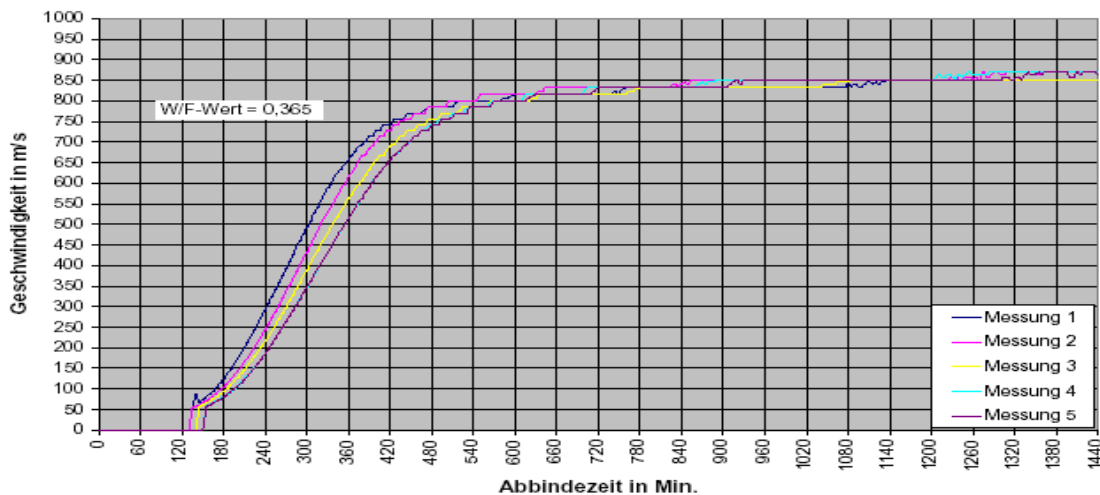


Bild 2a: Reproduzierbarkeitsuntersuchungen zum Erhärten von Kalk-Gips-Putz 150 (Kissing) mit der Ultraschall-Messzelle (Kunststoff)

Ultrasonic sound speed in m/s over time in minutes - 5 times measured with same material and the same water/binder ratio

Test with the **Vikasonic Method**

With the ultrasonic test the deviation was 18%. So the ultrasonic method is more accurate than the Vicat method.

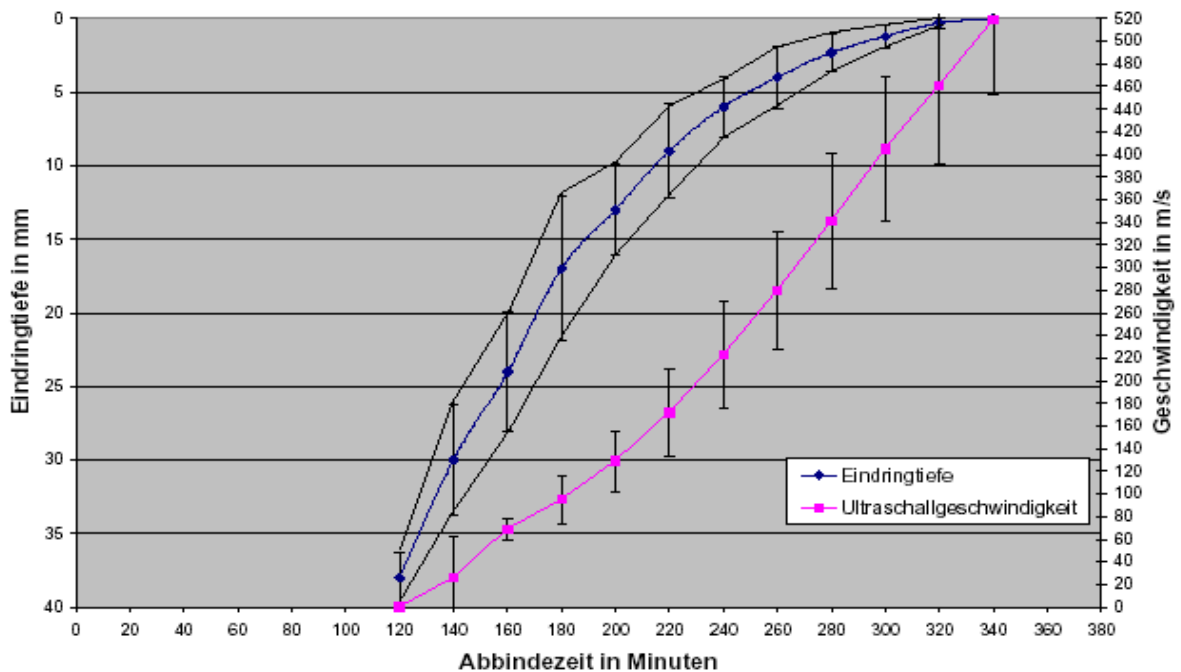


Bild 3a: Zum Zusammenhang zwischen Abbinden (Eindringtiefe) und Erhärten (Ultraschallgeschwindigkeit) am Beispiel des 150er - Kissing

Penetration depth (blue) in mm and ultrasonic sound speed (magenta) in m/s over time in minutes - 5 times measured with same material and the same water/binder ratio

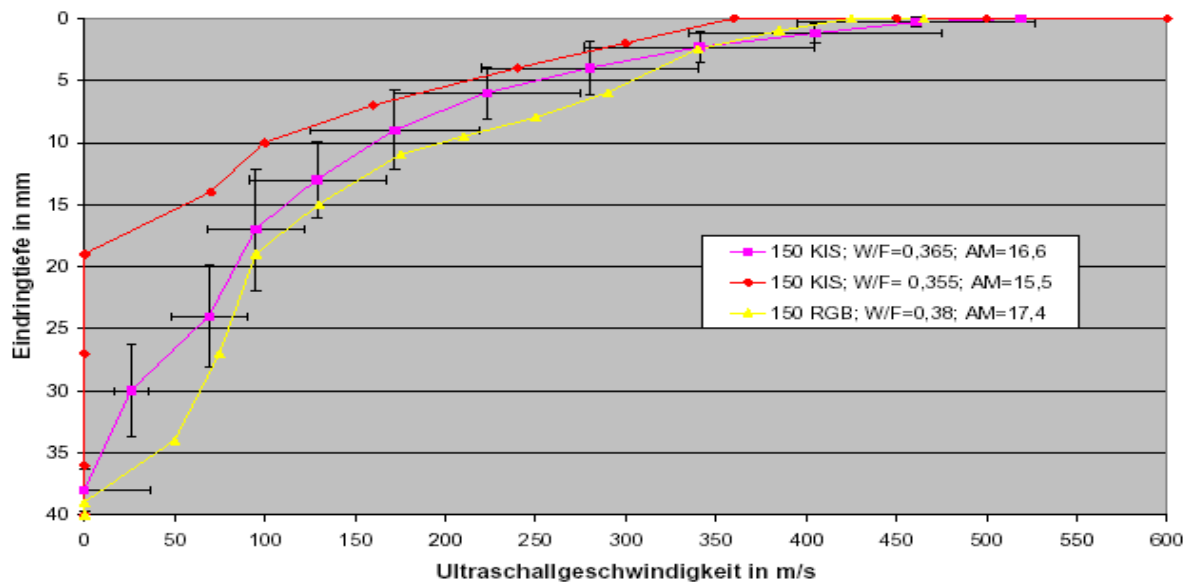


Bild 5: Zusammenhang zwischen dem Abbinden (Abbindezeit) und Erhärten (Ultraschallmesszelle) nach gleichen Zeiten

Penetration depth in mm over the ultrasonic sound speed for 2 materials (KIS) with different water/binder ratio and another material (RGB)

Comparison of Both Methods

The correlation between the classic Vicat test and the **Vikasonic** ultrasonic method is different for various materials and mix designs. For each mix design a calibration between both methods must be done. Once you have got his curve the Vicat test may be replaced by the **Vikasonic** ultrasonic test. You get earlier results when the Vicat needle is still falling into the material, and you get also results when the material is already hardened.

The costs for an automatic Vicat apparatus are near the same as for the **Vikasonic** ultrasonic setup. But with the **Vikasonic** you can do this test with less man power and you will get more objective results.

Specification **Vikasonic***:

Transit Time Measurement Range	0.1µs to 65000µs
Frequency	54kHz, others available
Accuracy	+/- 0.1µs
Over Range Indication	shown on the display
Input Sensitivity	Better 250µV
Bandwidth -3db	10KHz .. 1 MHz
Transmitter Excitation Voltage	500V, 750V, 1000V, 1500V
Pulswidth	<= 1µs
Puls Rate	0.25...10 s
Power Supply	Mains or Internal Battery
Mains Input	110V .. 240V 50/60Hz
Battery	Three common AA cells
Display	Liquid Crystal 56mm x 38mm
USB interface	Host interface for a connecting an USB stick (2 sticks included)
Real Time Clock	integrated
Temperature measurement	Typ K thermocouple

* Changes that contribute to technical improvement are subject to alternations

Order Info

Schleibinger Vikasonic with test cell, transducers and thermocouple	U0010
--	-------

01/03/12

Schleibinger Geräte
Teubert u-. Greim GmbH
Gewerbestraße 4
84428 Buchbach

Germany
Tel. +49 8086 94010
Fax +49 8086 94014
Ust. ID DE 174 175 046

Amtsgericht Traunstein HRB 9646
e-mail info@schleibinger.com
<http://www.schleibinger.com>