

SONO WZ

The w/c analyzer for fresh concrete

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With the SONO WZ analyzer, the water content of fresh concrete can be quickly and precisely determined on site. The device is based on the innovative TRIME® radar technology and supports simple quality control procedures on the jobsite.

The SONO WZ device consists of a lancehead-shaped probe as well as a portable measuring instrument for displaying the measurement results. By taking 4 to 5 measurements, reliable information regarding the water content in fresh concrete can be achieved within 1 to 2 minutes.

Compared to the conventional method that has been used up to now for measuring water content using a complex test set-up for the so-called Darr procedure, the PERI SONO WZ analyzer leads to considerable time savings on the jobsite.

Reliable on-site quality control

Reliable measurement results of the water content in fresh concrete by means of the innovative TRIME® radar technology

Easy and simple handling without any time-consuming set-up procedure

Fast measuring thanks to a simple and structured approach – without the need for any elaborate test set-up



The PERI SONO w/c analyzer consists of a measuring probe and a hand-held transmitter with a display. The fresh concrete measurements are carried out in a common plastic bucket.

Reliable on-site quality control

SONO WZ works on the basis of radar technology using the very latest TRIME® TDR technology (Time Domain Reflectometer). This innovative technology has been proven through many years of collaboration with a number of scientific institutions.

With the so-called propagation time measurement, a radar pulse is used to determine the volumetric water content. The technology is successfully used for a range of moisture measurements. The procedure has been further developed for measuring moisture content in fresh concrete. The special probe and corresponding hand-held measuring device now provide a simple solution which guarantees reliable results on the construction site.

How does it work?

The technology is based on the TDR principle, also called cable radar. In the process, a high-frequency TDR pulse generated in the device runs along a probe and builds up an electromagnetic field around the TRIME probe. At the end of the conductor, the pulse is completely reflected and travels back to the source. The duration of the impulse along the measuring probe is directly linked to the volumetric water content and thus provides the desired result.

Easy and simple handling

The measurement sequence is simple and structured whereby no special measurement set-up is required on the construction site. The measured result is the water content in l per m³ of concrete whilst taking into account the previously entered bulk density of the concrete. The measurement result can then be used to calculate the w/c ratio.

The moisture measurement with SONO WZ is carried out in commercially available 12 l plastic buckets. The probe is inserted at the edge of the bucket and the measuring procedure is started by pressing a button on the hand sensor. For a representative and reliable result, four to five measurements must be taken in one bucket. After each individual measurement, the hand-held measuring device displays the accumulated mean value of the sample taken; the entire measurement procedure usually takes no longer than 2 minutes.

Using a range of settings, the SONO WZ can also be used for newly developed concrete types such as fibre concrete or self-compacting concrete.



SONO WZ measures the total water content of the fresh concrete mix. This includes the effective amount of water, parts of the water in the aggregate as well as additives that behave like water.

A short overview of the application

1. The device

The hand-held measuring instrument is very easy to use as it only has four different buttons: the two arrow buttons are used to select the setting options, the "measure" button starts the measuring procedure and the "settings" button is used to access the setting parameters.



2. Pre-measurement settings

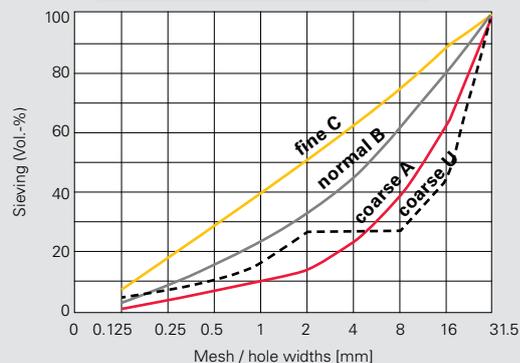
Before taking measurements, three parameters must be entered: bulk density, characteristics of the concrete composition and the General-Set.

1. Bulk density (Display: Density)

Here, the value of the test sample is entered or, alternatively, the bulk density resulting from the mixture calculation or delivery note. If the bulk density cannot be determined on site, the target bulk density value can also be entered.

Tip

When creating the sample cube, weigh the cube in the formwork; subtract the weight of the formwork from the determined weight. The bulk density is obtained by dividing the weight thus determined by the volume of the cube.



With its radar measuring field, the SONO WZ reveals a range of grading curve dependencies with differing recipe characteristics. As a result, the analyzer provides four different setting possibilities which are entered using the so-called CHAR parameters.

2. The characteristic of the concrete recipe (Display: CHAR)

The finer the grading curve is, the higher the actual water content. On the basis of the corresponding characteristic of the recipe, the device thus considers any minor corrections in the calculations. The table shows the four possibilities.

Fine C	Normal B	Coarse A	Special U
<p>Grading Curve C The SONO WZ measures an insufficient amount of water and, therefore, needs to correct the water content slightly upwards.</p> <p>Concrete with a high mortar content, i.e. a lot of sand, especially with high content of fine material, a lot of cement. Standard additives, standard admixtures also PCEs.</p>	<p>Grading Curve B No or only slight corrections.</p> <p>Continuous and relatively well-distributed grading curves. Standard additives, standard admixtures also PCEs.</p>	<p>Grading Curve A The SONO WZ measures too much water and, therefore, needs to correct the water content slightly downwards.</p> <p>Concrete with higher k-values and low mortar content. Concrete with continuous and relatively well distributed B-grading curves with a special feature: low target water content which is less than 160 l/m³ as well as a lot of PCE high-performance superplasticizer which ensures the general flowability.</p>	<p>Gap Grading U The SONO WZ measures too much and must, therefore, correct the water content downwards.</p> <p>Gap Grading U: i.e. very little or no 2/8 or 4/8 gravel. Standard additives, standard admixtures also PCEs.</p>

3. The General setting (Display: G-Set +/-)

The General-Set should be adjusted for special types of concrete. The G-Set value is entered using l/m³ and can be varied from 1 l to +/- 50 l.

3. Measuring

With the SONO WZ analyzer, concrete can be sampled with a flow spread from F2 to F6. A commercially available 12-litre plastic bucket, which is about $\frac{3}{4}$ -filled with concrete, is ideally suited for carrying out the measurement. The best results can be achieved through four to five individual measurements at different positions in the bucket, i.e. each offset by 70° to 90°.

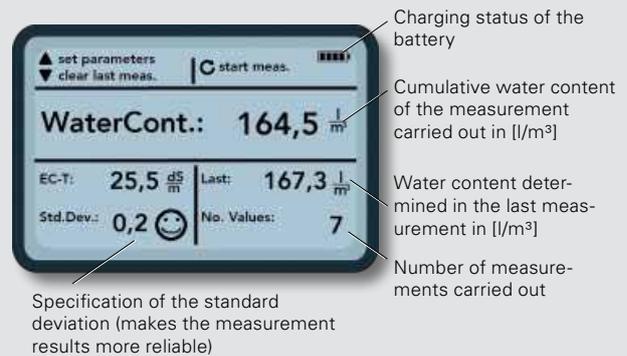
After inserting the probe in each position, the concrete should be somewhat compacted by tapping sideways (e.g. with the foot) so that the concrete fully encloses the surface of the probe. The individual measurement is then started by pressing a button. With each successive measurement, the hand-held device shows the accumulated water content of the measurements previously carried out.



4. Measurement results

The handheld device shows the water content in the fresh concrete with an accuracy of $\pm 3 \text{ l/m}^3$. The actual w/c ratio can then simply be calculated on the basis of this water content and the cement content (specified in kg on the delivery note).

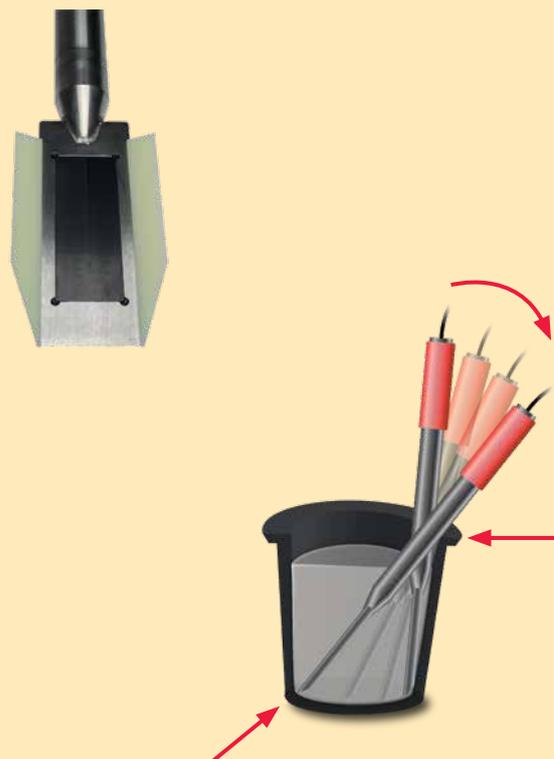
The actual data for the w/c ratio or water content thus determined provides a high degree of reliability in the production of standard-compliant concrete.



Recommendation for concrete with slump-flow F5 and F6

Highly flowable concrete has a tendency to separate. Therefore, there is a risk that the larger fractions accumulate at the bottom of the bucket. Furthermore, fine particles can accumulate on the probe surface after the probe has been inserted. In this case, an excessively high water content might possibly be measured.

For concrete with slump-flow F5 to F6, it is therefore recommended to use the so-called w/c shovel made of plastic which is placed on the probe head before the measuring process takes place. The shovel ensures that the larger pieces of gravel do not "drift" away laterally from the probe head during the measurement.



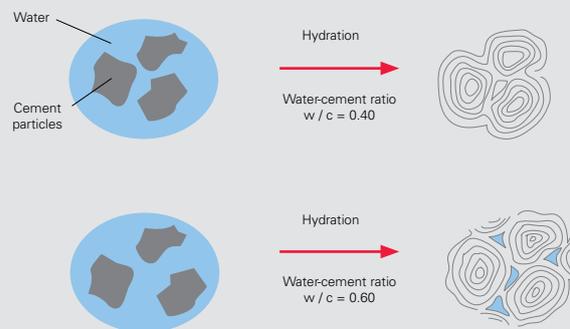
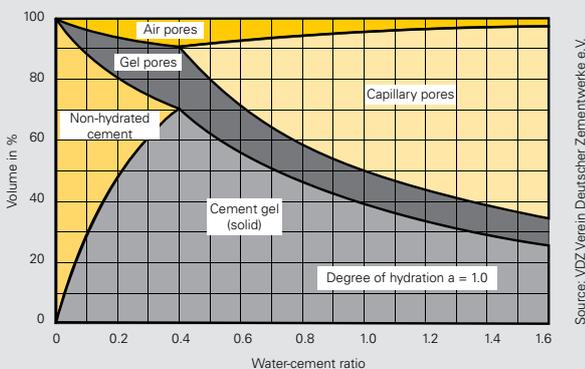
The w/c ratio describes the ratio between the mass of the mixing water and the mass of the cement or binder. But what causes the w/c ratio and why is the value so important?

The water in the fresh concrete is required for the chemical reactions during the setting of the concrete. In the process, the mixture of cement and water hardens to form cement stone which then firmly connects the aggregate used.

Typical cement can chemically and physically bind a quantity of water of approx. 40 % of its mass. Basically, the following applies: the higher the load and stress on the concrete, the lower the w/c ratio selected. The w/c ratio is therefore an important indicator for quality control.

This process is therefore significantly influenced by the ratio of the water and cement content: if the water content is too high, the water cannot be completely bonded. The excess water leaves behind very absorbent, branched (capillary) pores. Consequently, this results in a lower load-bearing capacity and poor durability of the hardened concrete. If, on the other hand, the water content is too low, only a part of the binder used can harden. Among other things, this means there is an increased risk that the reinforcing steel will not be completely enclosed by the concrete.

For the production of fresh concrete, the quantity of the cement as well as the mixing water are calculated precisely. However, the actual water/cement value may deviate from the calculated value, e.g. due to small amounts of residual water in the concrete mixing transport truck or due to the addition of mixing water on site. Testing the actual water content or the w/c ratio prior to pouring the concrete thus ensures more reliability regarding the expected concrete result – long before the results of the cube tests are known.



The w/c ratio determines the proportion of cement gel, capillary and air pores in the hardened concrete and thus has a great influence on the load-bearing capacity and durability of the concrete.

The hydration describes the chemical reaction between the main components of the cement and mixing water during setting. If the water content is too high, this leads to capillary pores and a lower concrete quality.

What alternative methods are there to determine the w/c ratio?

Up to now, the water content has usually been determined on site using the so-called Darr method. Thereby, the loss of mass on a fresh concrete sample is determined by harsh and rapid drying with constant stirring. The water content is then calculated from the loss of mass. The Darr method is very complex and a corresponding test set-up is also required. The SONO WZ analyzer therefore saves a considerable amount of time and effort.

<p>Darren measured material: 3 kg</p> <p>30 min.</p>	<p>SONO WZ measured material: 20 kg</p> <p>2 min.</p>
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for every Project and
every Requirement**



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