QAVER®tec GmbH, Flensburg; products for checking concrete

Control unit for assuring the quality of paving stone production

The Qaver (= Quality for Paver), the new checking appliance for assuring the quality of concrete goods, had already convinced a few months after its successful market introduction due to its versatility and reliability. The Qaver was developed as a measuring instrument for fresh concrete goods, in particular paving stones, in order to specifically enable the measurement and evaluation of the quality of compaction of the facing and core concrete as well as the gross density and dimensional stability of the product directly after production. The measuring unit is complemented by an external evaluation program, which is employed in combination with the measurement results from the Qaver as a uniform quality assurance system. This means: the consistent use of the measuring instrument to measure the physical characteristics of concrete blocks directly in the plant, combined with the specially developed program for evaluating the measurement data in the laboratory, provides the manufacturer for the first time with a tool for optimising production parameters and sensitising the personnel on the machine. Furthermore, Qaver offers possibilities to extract the optimum savings potential from mixture recipes, in particular where binding agents and/or other substitutes are concerned. The Qaver is considered to be unique in the world with this overall concept.

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The test device convinces through simple handling

In order to ensure and guarantee the constant quality of fresh concrete goods in their current manufacturing processes and for subsequent production, the Qaver enables the physical characteristics of the products to be precisely measured, evaluated and saved. The evaluation of the quality of compaction of facing and core concrete, which is determined via the gas permeability of the capillary pore microstructure, as well as the measurement of the current gross density and the height of the concrete stone, form the basic parts of the measuring instrument. Directly after the product comes out of the block making machine, a stone is removed by a lifting device and all measurements are carried out within a matter of seconds. Each of these measurement results is compared with a product-specific permissible limit range. On the basis of this limit range, the Qaver recognises whether and how well the quality of the target result has been achieved and displays this visually. The Qaver indicates to the user immediately whether or not the works' own quality standards have been met. Each individual result is displayed in signal colours according to the tolerances, so that the user can see at a glance whether

- the block meets the specified standard (green),
- lies within the critical range (yellow)
- or deviates significantly from the specifications (red).

Fig. 1: The Qaver is placed directly on the plant and requires only a 220 V supply for operation. The lifting device enables paving stones to be lifted to a height of 140 mm or a weight of up to 12 kg. Various types of suction cup are available for different surface properties.

The Qaver enables quality characteristics to be detected consistently, is an aid to complying with quality specifications and, following the initialisation phase, can even predict the quality characteristics of the hardened concrete. Furthermore, all deviations and outliers are measured and documented extensively during production.

Evaluation program

The essential function of the evaluation program is to display the measurement results from the Qaver together with the production data from the production hall in a visual form and, hence, to establish a connection between the determined fresh concrete data and the subsequent hardened concrete characteristics. This program can

be installed both in the laboratory and on most PCs. Hence, independent of the location of the Qaver, every user of the program can see which quality was produced by who, when, where and in which time period and whether or not the works' own quality standards have been met. In addition to that, the program can be translated without problem into any desired language and corresponding parameter names can be changed to in-house terms. All data measured by Qaver is imported via a data carrier from the outside into the evaluation program.
The evaluation program essentially consists of three parts:

- the evaluation of the individual measurements,
- the evaluation of the board analyses,
- the area in which values can be added

Single measurements

In order to analyse the single measurements, the search function can call up the corresponding Qavers, which display the product name, the name of the machine operator, the date and the time, all linked to one another. Hence, for each person or product, it is possible to find out who produced what, when and where. For example, indi-

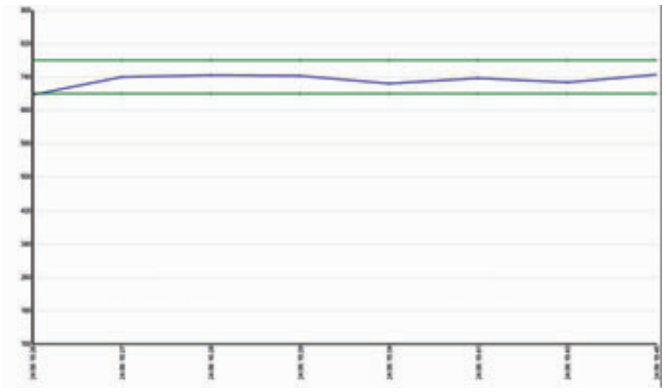

Fig. 2: Example display of the compaction quality of the core concrete from an even production over 8 measurements. The blue line shows the connected measurement points. The green lines mark the limit range of the tolerance entered in the Qaver for the product.

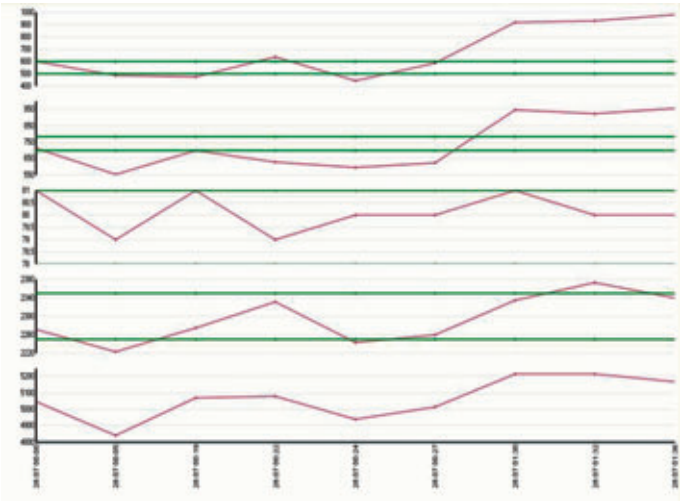

Fig. 3: Example display of all five measurements from a production with large fluctuations in quality (the red lines each represent the connected 9 measurement points) over the time axis with tolerances (green lines). From top to bottom in the display: 1. Compaction of facing concrete, 2. Compaction of core concrete, 3. Height of the product, 4. Gross density of the product, 5. Weight (without limit lines)

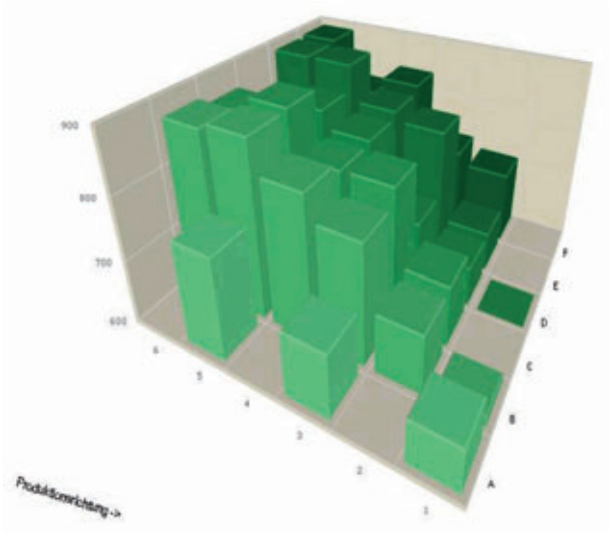

Fig. 4a: Example display of uneven quality of compaction of the core concrete on a production board

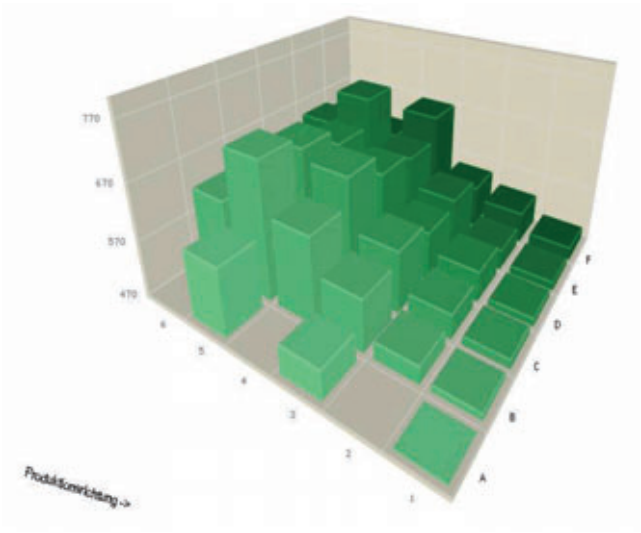

Fig. 4b: Display of the quality of compaction of the facing concrete on the same board

vidual daily shifts and particular production steps can be displayed. In the result overview, the five relevant Qaver measurement results (compaction of facing concrete, compaction of core concrete, actual product height, actual gross density and actual weight) are listed along with the comments of the machine operator, who has the possibility to enter a comment text or remark immediately after the measurement on the Qaver. From this table, all measurement results can be displayed as a single graph, as well as coupled with the other four results, in relation to the time of production, with the specified limit lines (see figs 2 and 3).

Hence, all measurement results can be displayed, visually referenced to the time of measurement. On account of this display, all outliers and abnormalities can be clearly identified and analysed. All displays can be saved as PDF files or printed out at any time.

Board analysis

The board analysis can be selected in the Qaver as an additional program option for individual measurement in the measuring instrument. When this option is selected, the Qaver illustrates the stones/distribution on the production board on the display of the Qaver. With the measuring instrument, the operator can now optionally select some or, in the system, all of the stones for measurement and then perform the measurement according to the same principle as the stone-by-stone individual measurement. For each of these stones, the position of the stone is saved in addition to the quality of compaction of its facing and core concrete, and its height, weight and gross density. After completion, this analysis is saved in the Qaver's database. When the data is subsequently transmitted, the data sets are automatically read out and transferred to the evaluation program.

Using a similar search mask to that used for the single measurement, the evaluation program enables a search to be made for analyses that have been carried out. In the result view, the results from the Qaver measurements are then displayed with the additional coordinates. From this view, each of the five measured values can be displayed in the form of a 3D illustration (see fig. 4). High columns mean a high quality of compaction in this case. Low columns

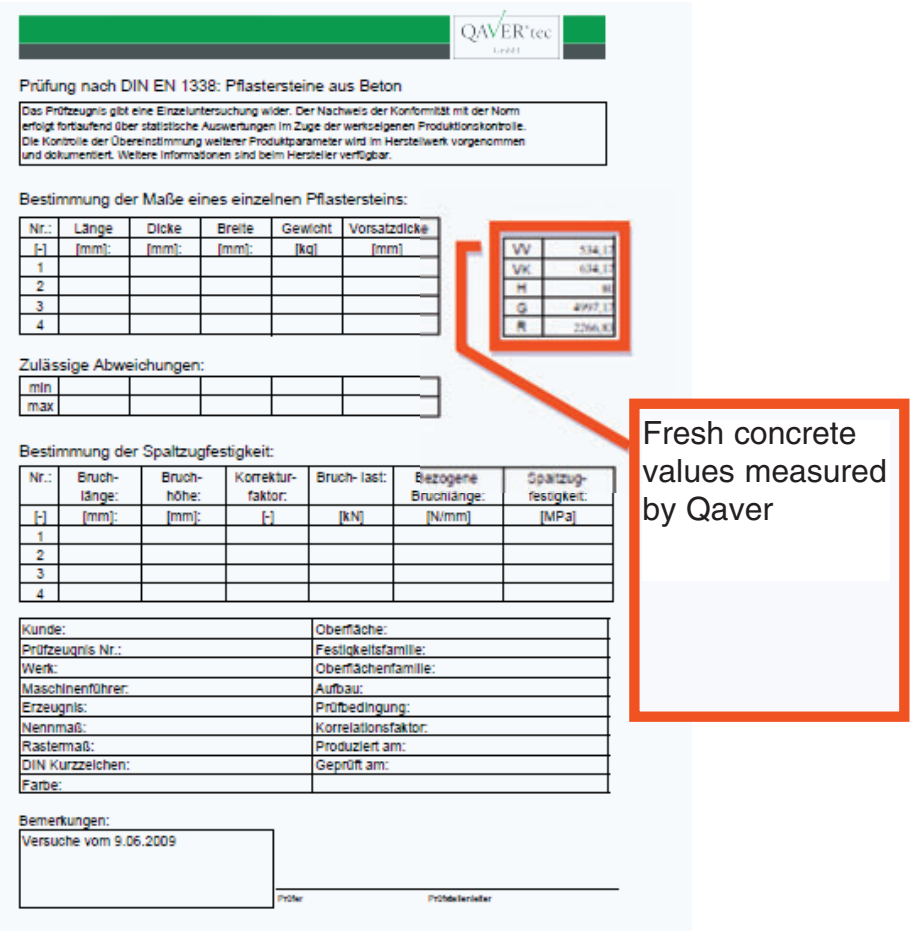

Fig. 5: With the recognition aid, the parameters for the setting of the Qaver limit values can be continually further optimised. This program option is also ideal for the evaluation of tests with new raw materials or in the case of recipe changes, since the Qaver creates absolute comparability due to the repeatability of its results.

mean low quality of compaction, that is to say higher porosity of the individual products.

The board analysis allows the user to get a quick overview of the quality of the stones on the production board. This type of display therefore enables the appropriate conclusions to be drawn in order to precisely adjust the machine parameters so that products from one lot that differ in quality like this are not produced permanently.

Adding values

The Qaver can also process values from a subsequent test on hardened concrete. In order to be able to match measurement results unambiguously to stones, the procedure is as follows: before a single measurement is carried out on the fresh concrete, there is an option to scan the code from a transponder chip. The Qaver now knows that the stone to be subsequently tested is assigned to precisely this transponder chip. The transponder chip is then placed on the production board at the position from which the stone was removed. The stone is tested by the Qaver and the results are saved. The transponder chip remains in the meantime on the production board until the stones have set. After that, the two set stones lying adjacent to the transponder chip can be checked in the laboratory. Parallel to that, in the evaluation program, the measurement results can then be retrieved for the stone that was tested beforehand in the production.
Hence, the user can transfer both the fresh concrete values and the hardened concrete values in one electronic input form, e.g. as per DIN 1338 (fig. 5). This form can be printed out and also saved as a PDF file.

Advantages and conclusion

In combination with the evaluation program, the Qaver, an individual measuring instrument with high checking capabilities, repeatability and informative value, has enormous potential with regard to the long-term savings possibilities for binding agents and/or substitutes. The system allows precise detection of quality. Using the Qaver, optimum evenness and homogeneity of the paving stone production can be achieved and secured in the long term. In conjunction with the evaluation program, it enables the permanent checking of production quality. The Qaver provides unmistakeable information

- for the reduction of scrap production
- for the promotion of the homogeneity of the products
- for the optimum use of the raw materials
- for the sensitisation of personnel.

As a compact device and evaluation unit, it performs the function of an independent checker as it were, because, thanks to the special characteristics of the software, the measured values cannot be falsified. The measuring instrument guarantees the consistent monitoring of plant and product, objectively and independent of personnel. With the aid of the Qaver, potentials for saving on raw materials can be opened up, qualities can be improved and the homogeneity of the concrete goods can be ensured.

FURTHER INFORMATION

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