RapidAir

Purpose

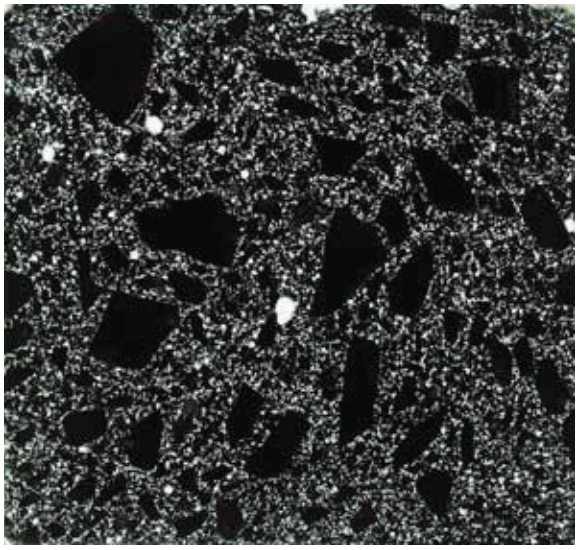
RapidAir is an image analysis system for automatic determination of the air content in hardened concrete according to the linear traverse method in ASTM C457: "Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete."

The measured parameters of the air-void structure are total air content, spacing factor, and specific surface.

Principle

A core is taken from the structure, sliced, ground, and lapped in the laboratory. The resulting surface is plane, smooth, and with sharp edges along the perimeter of air voids. Before final specimen preparation, the lapping quality is checked under a stereomicroscope.

The lapped surface is colored black with a hard stamp pad containing black ink. After heating the specimen to 55 °C, a white zinc paste is applied to the surface with a rubber spatula. The zinc paste melts on the surface and flows into the voids.

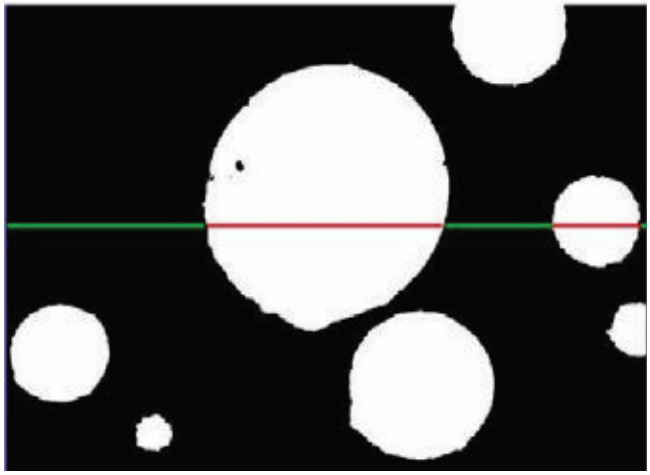


After cooling to room temperature, excess paste is removed from the surface with a straight, sharp steel blade. The quality of the black-white contrast is checked under a stereomicroscope. The voids should be totally filled with white paste and no white regions should be visible on the surface. Finally, voids in aggregates and obvious cracks are colored black under the stereomicroscope using a black marking pen. The photo on the left shows a properly prepared specimen.

The preparation of a well-lapped specimen surface for analysis takes about 30 minutes. The **RapidAir** measurement is done automatically in less than 17 minutes. This should be compared with a time of 4 to 6 hours normally required for manual analysis using a light microscope in accordance with ASTM C457.

Following contrast enhancement, the prepared specimen is mounted on a moving X-Y-Z stage positioned below a video camera.

The **RapidAir** control unit automatically moves the stage, and the software determines the portion of the total traverse length that passes through the white air voids, as shown in the magnified view to the right. After the scan is completed, the air-void parameters are determined in accordance with ASTM C457.



The specimen scan is saved automatically in a report file documenting the air content, spacing factor, and specific surface. In addition, graphical presentation of the air-void distribution and the raw data are available.

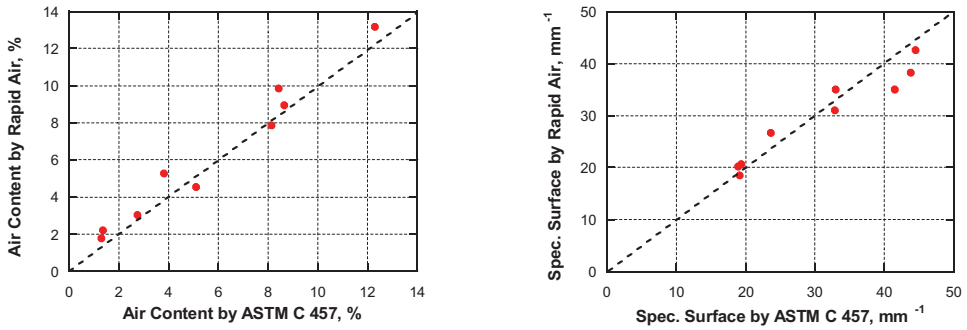
Prepared specimen positioned on the moveable stage ready for image analysis.

Overall view of **RapidAir** *system in operation.*

Correlation with ASTM C457 and Precision

As reported in Pade, C., Jakobsen, U.H. and Elsen, J., "A New Automatic Analysis System for Analyzing the Air Void System in Hardened Concrete," *International Cement Microscopy Association Conference*, San Diego, CA, USA, April 2002, very good agreement was found between the air-void system parameters measured by the **RapidAir** system and by the ASTM C 457 standard method. The study involved thirteen European laboratories. The standard deviations of the air-void parameters determined by **RapidAir** were as follows:

- Air content: 0.37 %
- Specific surface: 1.57 mm^{-1}
- Spacing factor: 0.011 mm



Comparison between **RapidAir** *and ASTM C457 determinations of air content and specific surface*

RapidAir Ordering Number

The **RapidAir-3000** system shown to the right comes as a complete system, ready to plug in and operate, including PC with software, control unit, and manual.

A one day course is offered separately by a **RapidAir** specialist.

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