

# Automatic Image Analysis in evaluation of the air entrainment of concrete

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## Summary

Air entrainment has an effect on frost resistance of concrete, depending on the structure of air voids. Quantity of the air in concrete is not a parameter, that determines efficiency of air entrainment. Instead, such a parameter is the spacing of air voids. It has been verified that the spacing factor of the air bubbles, as defined in ASTM C 457, can be evaluated by means of modern image analysis systems (IA), with the images of the concrete sections captured using a high quality digital photo-camera, a video camera plus a frame grabber, or a scanner.

For the analysis used was *Morphopericolor* system, that enables grabbing images 512x512 pixels, in 64 levels of grey. The sample of concrete was prepared by a special process, in order to contrast the air voids on the surface of concrete.

In the paper presented are formulae for calculating the spacing factor from the output of the IA system. Tested were effects of the technique of specimen preparation, its lighting, assumed threshold levels, etc. Discussed was the accuracy of the measurements. Suggested is preparation of a proper reference for calibration in similar measurements, the tool highly needed, but so far non-existent.

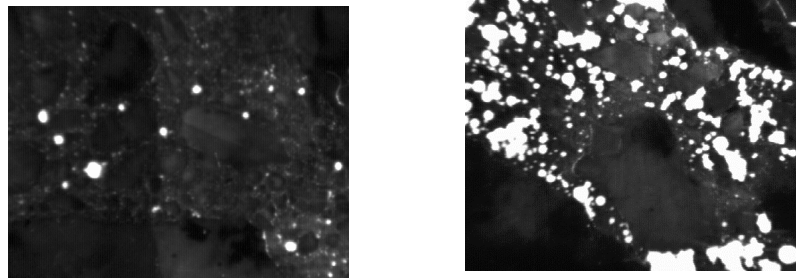


Fig.1. Two examples of images analysed by the system *Morphopericolor*. On the left side: the sample of 1% of air, on the right side: the sample of 11% of air.

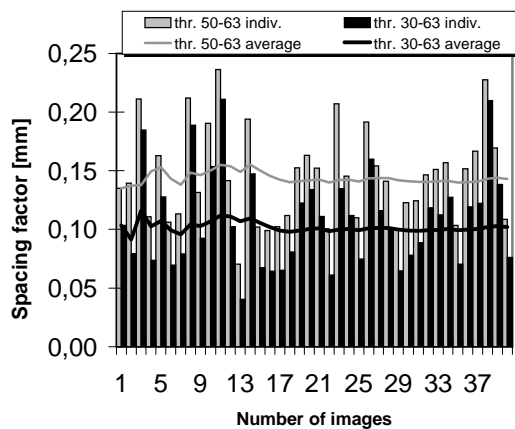


Fig.2. Observed effect concerning the influence of the assumed threshold level on the value of the spacing factor, in function of the number of the fields tested.