

Bugholes: How many are too many, if they can be measured?

Bugholes (air voids) are a common feature in formed concrete surfaces such as walls and columns. For concrete surfaces not exposed to view, this isn't a problem. But for exposed surfaces, especially architectural concrete, bugholes that are too large or too numerous may be objectionable. To provide a supplemental tool for defining, specifying, and evaluating concrete surfaces, ACI Committee 347 produced a "Guide to Formed Concrete Surfaces" (ACI 347.3R-13). The Guide defines four quality levels (classifications) of formed concrete surfaces and provides methods to achieve and evaluate them. These quality levels are affected by three surface finish categories: 1) form facing; 2) concrete surface void ratio; and 3) characteristics of form-facing materials.

In response to members' concerns with the Guide's recommendations for specifying concrete surfaces, the ASCC Foundation funded a research project titled "Evaluation and Examination of ACI 347.3R "Guide to Formed Concrete Surfaces." The research is being conducted in cooperation with the Middle Tennessee State University Concrete Industry Management (CIM) program. Further funding has been provided by the RMC Foundation of NRMCA and the ACI Foundation. CIM schools in other states will be invited to participate in the research when measurements are made on exposed vertical surfaces.

Based on concrete surface photos, Dr. Heather Brown's students in her Senior Concrete Research class have been evaluating different methods for measuring the area of air voids (bugholes) on surfaces, based upon time needed for measurement, cost of measuring equipment, and accuracy and precision of the methods. In late April they moved their research to the field as students in the Formwork for Concrete class formed up a U-shaped wall section, placed and consolidated the concrete and stripped the forms. These walls will serve as permanent control surfaces on which multiple measurements can be made using different methods. Color changes will also be observed by taking photos at regular intervals. All of the data, plus other results of the document evaluation, will be made available to ACI 347 for their use when ACI 347R is revised.

ASCC participants in the field work were Dr. Ward Malisch, principal investigator for the project, and Dr. Bruce Suprenant, ASCC technical director.