



Report on Training: AVA-3000 Air-Void Analyzer

Copenhagen, Denmark, March 4, 2025

Participants:

8 people from the Czech Republic working for Betotech, Master Builders Solutions, TBG Metrostav and The Klokner Institute of the Czech Technical University.

Teachers Hugo Orozco and Ricardo de Leon, both from Germann Instruments A/S

Introduction:

Concrete durability in freeze-thaw environments depends on the precise characterization of its air-void system. Inadequate air entrainment can lead to very premature failures, such as cracking, scaling and delaminations which reduce significantly the service life of the infrastructure.

A training session was conducted in Germann Instruments, Denmark, to address this concern, focusing on air-void analysis test equipment for fresh concrete samples (AVA-3000), and the interpretation of key parameters: *spacing factor* and *specific surface*, and how they correlate to freeze-thaw durability. The attendees, comprising materials scientists and civil engineers, were introduced to the Air-Void Analyzer testing system with a training that consisted of a theoretical session on the fundamentals of the subject and a practical session where the correct use of the equipment during a typical complete test was witnessed and the interpretation of the results was discussed.

Key Concepts:

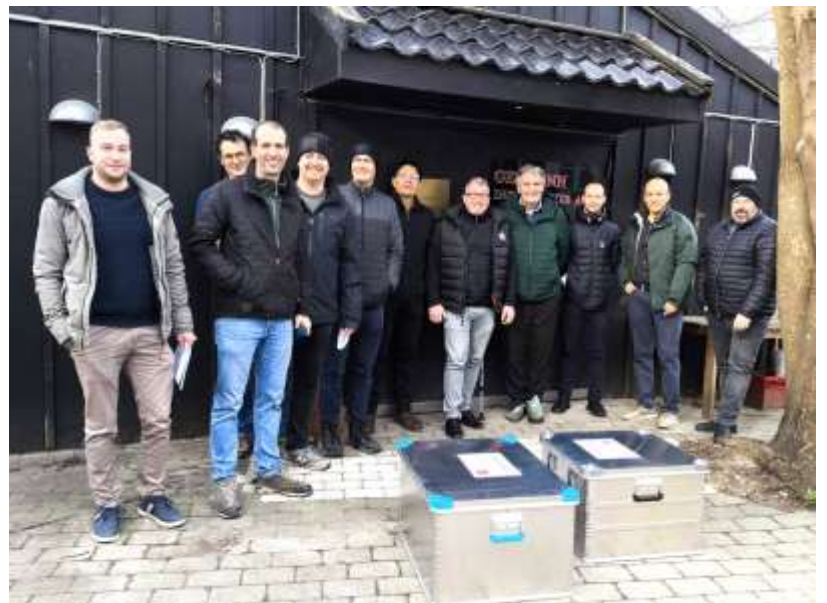
- **Air-Void Parameters:** The spacing factor (critical threshold: ≤ 0.200 mm) and specific surface (≥ 25 mm²/mm³) were discussed as determinants of freeze-thaw resistance. Attendees learned how these parameters act as "pressure relief chambers" to prevent internal stress buildup during freezing of water and expansion in the micro capillary pores of the paste and how these critical threshold values have been well studied in correlation with tests that determine the resistance of concrete to repeated cycles of freezing and thawing in the lab, such as ASTM C215.
- **Testing Standards:** ASTM C457 and ASTM C215 procedures were outlined. Automated systems for air void analysis (e.g., RapidAir) were contrasted with traditional microscopy, highlighting gains in speed, reproducibility, and reduced human error.
- **Equipment Demonstration:** Hands-on session allowed participants to see the complete operation of the AVA-3000 air void test system and to solve practical questions on the go. They could see directly that the AVA-3000 has notable advantages compared to traditional ASTM C457 methods for analyzing air-voids in concrete:



GERMANN INSTRUMENTS

Test Right – Sleep Tight

- gives real-time analysis by testing fresh concrete samples directly, yielding results in less than 30 minutes. This allows proactive quality assurance by making prompt adjustments to the mix design during concrete casting, ensuring compliance with specifications, or rejection.
- automates the measurement of air-void parameters, using buoyancy principles and software algorithms. This reduces dependence on technician skill and minimizes subjectivity in contrast to ASTM C457 manual microscopy
- eliminates high expenses related to sample curing, storage, and labor-intensive sample preparation (cutting and polishing) and ASTM C457 analysis.





Importance of Testing for Freeze-Thaw Resistance:

Real-world examples (e.g., bridge deck deterioration) highlighted the consequences of neglecting air-void analysis. The training reinforced that proactive testing is not merely a compliance exercise but a safeguard against structural compromise and costly rehabilitations.

Attendee Engagement:

The attendees were enthusiastic and had interesting questions that encouraged discussion. Some had already experience using a previous version of the equipment and provided valuable tips. Others commented that they are forming an inter-institutional working team to draft and promote the publication of a national standard test method on the use of the Air Void Analyzer, so it is part of the plan to acquire more pieces of equipment by the end of the year or early next year.

Attendee Evaluation

The Score gave the Highest evaluation from all the 8 attendees

Comments:

Excellent instructors, both, with very deep knowledge
Good precise explanation of the types of air voids and their role in concrete
Practical lessons gave fine input
Perfect course including illustrative detailed test preparation
The practical part was very good
AVA presentation was very good with details of how to perform the test

Conclusion

The training bridged theoretical knowledge and practical application. Participants understood how precise air-void analysis directly correlates to freeze-thaw durability. Their investment in the AVA-3000 test equipment reflects a commitment to research quality and to contribute to resilient infrastructure solutions. By adopting these test methods, they want to developing concrete mixes that withstand better harsh climatic challenges, ensuring longevity and safety.

*Report Prepared by: Hugo Orozco
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