

Effectiveness of blended cements for the long-term AAR-resistance of concrete

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Numerous concrete structures in Switzerland are damaged by AAR. The concrete performance test (CPT) is used to assess the AAR-resistance of concrete for new structures. The use of the method has originally been defined in the SIA guideline 2042 and has been upgraded into the revised Swiss standard SIA 262-1 in 2019.

The decisive aspect of accelerated tests is their transferability to concrete structures. In an ASTRA-project this has been confirmed to be the case for concrete produced with CEM I. However, the situation is more complex for concrete containing mineral additions as shown in a subsequent ASTRA-project. The effectiveness of mineral additions to prevent AAR was not completely conclusive. This applies as well to the blended cements used nowadays in Switzerland.

Different countries have established exposure sites with large concrete specimens stored in natural outdoor conditions in order to better assess the transferability of the results obtained with the CPT. This approach makes it possible to quantitatively compare the expansion in the CPT and concrete stored in natural conditions.

Such a comparison is considerably more accurate than the one conducted directly with concrete structures. The latter delivers only qualitative results, as the expansion in concrete structures is difficult to assess. It may vary from component to component due to differences in the degree of reinforcement and stress state.

A validation between the CPT and naturally exposed concrete cubes (measurement period: 15 years) will show, if the blended cements currently used in Switzerland ensure a high resistance towards AAR.

19 Concrete mixtures were produced in 2022. Their expansion was determined with the CPT. Additionally, cubes were exposed in Dübendorf and on the roof of a gondola station at Grimsel pass. The expansion of the cubes is determined twice per year. It is expected that a first trend allowing a first comparison with the CPT will be visible after three years. A comprehensive report will be produced in 2027, while an addendum containing the expansion values of 15 years will be delivered in 2037.