



---

## ABSTRACT

Concrete durability indicator tests offer robust assessment methods that can predict the durability performance of concrete infrastructure, particularly reinforced concrete structures. The South African Durability Index Approach (SADIA) and the Torrent method are two such techniques that have been implemented in South Africa and Switzerland, respectively, to characterise concrete durability performance. Expressly, the Oxygen Permeability Index (OPI) test and the Torrent Permeability Test (TPT) have been widely accepted as reliable performance-based techniques, with studies showing the sensitivity of the two methods to common intrinsic and extrinsic concrete properties. Recent studies have proposed a combined approach involving the OPI and TPT methods to refine current durability assessment practices in South Africa based on the synergies of the two methods. However, the existing evidence is based on simulated laboratory investigations and is yet to be verified and implemented on-site.

The objective of the present work was to develop practical guidelines for an integrated durability assessment strategy involving the OPI and the TPT method. Five concrete mix designs were used to create median barriers and test panels on-site. This aimed to explore the early age (28 – 56 days) performance of the concrete elements under various exposure conditions (summer and winter) in Cape Town, South Africa. The SADIA was applied to cored samples from the ‘mock’ panels in a laboratory environment, and the TPT method was conducted on the test panels and the barriers on site.

The measured permeability coefficients for both methods showed that the concrete elements under investigation performed within the specified limits for concretes in predominantly carbonation environments. Further, the laboratory data correlated reasonably well with the site data, agreeing with the general trend found in simulated studies. A moisture compensation approach was applied to the site data to account for the different exposure conditions; however, this did not result in any significant change in the overall correlation between the two methods. The results suggested that the OPI and the TPT can be used as a combined Durability Index (DI) approach with environment-specific guidelines for interpreting site measurements.

Therefore, a practical implementation strategy was proposed to enable non-destructive durability assessment using the TPT method, substantiated by the OPI test, where site data does not meet specified limits.

---