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SIMULATIONS OF ACCELERATED CORROSION TESTS IN CONCRETE PRISMS WITH A STEEL TUBE

B. Sanz[1*], J. Planas[1] and J. M. Sancho[2]

[1] Dep. Ciencia Materiales, Universidad Politécnica Madrid, E.T.S.I. Caminos, Canales y Puertos, C/ Profesor Aranguren s/n, 28040, Madrid, Spain
[2] Dep. Estructuras de Edificación, Universidad Politécnica de Madrid, E.T.S. Arquitectura, Avda. Juan Herrera 4, 28040, Madrid, Spain
* E-mail: bsanz@mater.upm.es

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Reinforced concrete structures that are exposed to marine environments often suffer corrosion of the steel reinforcement. As a consequence, the cross-sectional area of steel is reduced, but also the bond properties of the steel-concrete interface diminish and the volumetric expansion of the oxide leads to the cracking of concrete [1].

To reproduce such a cracking, the authors programmed an interface finite element called *expansive joint element* that reproduces the volumetric expansion of oxide [2] and works together with finite elements with an embedded adaptable cohesive crack [3], which reproduce cracking of concrete following the standard cohesive crack introduced by Hillerborg [4]. In previous works, that model was proved to properly reproduce the patterns of cracking observed in accelerated corrosion tests, assuming a fluid-like behavior for the oxide, as in [5]. However, some of the constitutive parameters of oxide had to be assumed, as there is a lack of experimental information about them, due to the difficulty to directly measure the properties of the oxide.

To obtain information about the process of cracking, accelerated corrosion tests were carried out on concrete prisms with a steel tube as reinforcement, which were very sensitive to the initiation of cracking. Then simulations on the tests were carried out on 2D FE models of the prisms with a tube and the measurements recorded in the tests were reproduced. The model captured the initiation of cracking and reproduced the shape of the experimental curves of results. To achieve a better fit to those curves, some of the parameters of oxide were modified *ad hoc*, finding that the simulations with the tube were more sensitive to variations in those parameters than the simulations in previous works with a bar. An example is shown in Fig. 1 for the width of the main crack, which was measured between points A and B, as seen in the left sketch. The parameters of

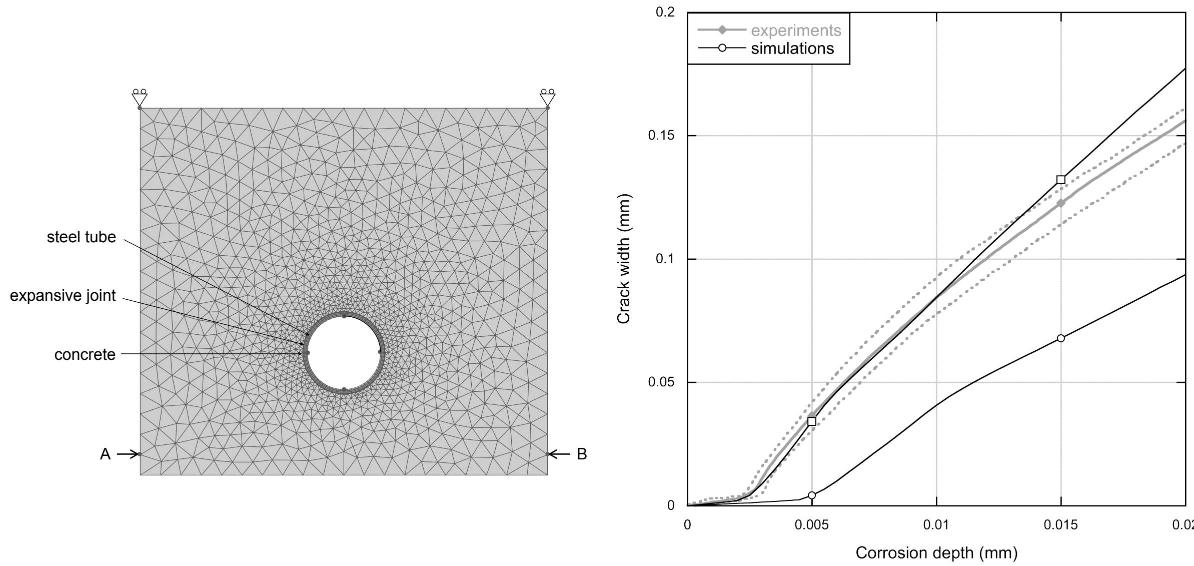

Figure 1: Simulations of the expansion of oxide in concrete prisms with a steel tube, in which the width of the main crack was measured at points A and B (left) and fit of the numerical curves to the experimental results (right).

the expansive joint element, in particular the expansion factor and the shear stiffness, were modified to achieve a good fitting of the experimental curves, as seen on the right. Further studies are needed to ascertain the influence of each parameter in the overall behavior and to determine the values that reproduce best the experimental results of all the measurements.

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