Reliability aspects on the residual service life estimation of as built and repaired RC and PC structures subjected to corrosion phenomena.

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Corrosion of steel reinforcements is nowadays considered as one of the most severe causes of the durability and capacity reduction of existing Reinforced Concrete (RC) and Prestressed Concrete (PC) structures and infrastructures.

The structural heritage is characterized by many structures that have already exceeded their design service life and show evident signs of deterioration. Therefore, the maintenance and repairing actions of existing structures and critical infrastructures are crucial to extend their residual service life. Furthermore, climate changes are increasing the frequency and magnitude of events that accelerate the corrosion damage phenomena.

The scientific literature is lacking methods able to evaluate all the relevant uncertainties in the assessment of the structural capacity of existing structures. Consequently, also in the daily engineering practice reliable estimations of the residual service life of corroded structures are missing. Indeed, engineering models are tailored based on levels of uncertainty related to the variability of material and geometrical properties of un-corroded members and based on calculation models suitable for un-corroded members. It results that the use of safety factors adopted for un-corroded members could provide un-safe assessments and that reliable procedures must be calibrated based on the corrosion level. For example, in guidelines and standard codes, the evaluation of Partial Safety Factors (PSF) for existing RC and PC structures do not explicitly consider the corrosion effects on reduced material characteristics. Therefore, in the PhD thesis the adoption of probabilistic methods for the assessment of the residual service life of structures, and the adoption of partial safety factors for the verification of corroded structures by simplified methods are investigated.

The PhD thesis will provide reliable methods for the capacity assessment and for the residual service life prediction of corroded structures, function of the level of knowledge of the structures and of the in-situ measurements of the corrosion rate, the damage induced by the deterioration process, the cracking, etc.

Finally, the studies carried out in PhD thesis deal to optimise the planning of repairing intervention to ensure a sustainable development of our society able to mitigate the effects of climate actions and aging in existing structures and infrastructures.

Professor Beatrice Belletti will supervise the PhD candidate.