Effects of corrosion on post-tensioned concrete bridges

Contact: Daniele Ferretti

The behaviour of prestressed concrete bridges with post-tensioned cables depends on the correct anchoring of the cables and their protection against corrosion. Particularly in older existing structures that have exceeded their design life, corrosion protection has often been inadequate and there are many structures with corrosion problems at the anchors or along the cables. Detecting these problems by visual inspection is not easy because the anchors are often inaccessible and the cables are covered by ducts and mortar. For these cases, non-destructive methods such as georadar or ultrasonic tomography are being studied and developed. However, the issue is still open and guidelines are being studied. Once the fault has been identified, the remaining resistance of the corroded cable must be estimated. If the cable is broken, it is necessary to calculate its re-anchorage length, i.e. the distance beyond which the cable regains its function. This information is important both for estimating the residual strength of the structure and for the correct design of the rehabilitation. The length of re-anchorage depends on the adhesion of the cable-duct-concrete system, a subject that has been little studied in the literature. The problem requires experimental studies and theoretical modelling. These will allow the definition of appropriate bond-slip laws to be used in both analytical and finite element modelling. Finite element models will make it possible to estimate the load-bearing capacity of the structure over time, calculate its residual life and plan rehabilitation interventions. The thesis will address the above issues from both a theoretical and experimental perspective.

Professor Daniele Ferretti will supervise the PhD candidate.