

Robustness and Life-Cycle Analysis (LCA) of Structures and Infrastructures

Joan R. Casas

Professor of Bridge Engineering

Technical University of Catalonia- BARCELONATECH

Because of limited available funding, an important issue when dealing with the life-cycle management of structures and infrastructures is to decide on the urgency of the repair/strengthening when there are not sufficient funds to perform all the interventions necessary derived from the optimization problem. In other cases, the practical application in the field of the maintenance activities at different times, suggests to wait some additional period of time in order to get a minimum amount of work to be deployed in the existing infrastructure in just one main activity. In both cases, the decisions result on the no application of the maintenance/repair/strengthening work at the exact time proposed by the result of the life-cycle analysis. In both cases, a crucial question arises: How postponing a specific repair work can increase the repair costs disproportionately?

In the paper is proposed the measure of the robustness of the structure/infrastructure as the possible answer to this question. To this objective, two possible approaches are defined and, therefore, two indicators of structural robustness are proposed. The first one is included on the condition assessment of the structure and is able to quantify the effect of the damage/defect on the overall system behavior and not only at the member level. In the second case, robustness is defined as a structural property related to the tolerance to damage and is measured by the average performance considering all possible damage scenarios. In both cases, higher robustness will derive on higher adaptability of the system to postpone the necessary interventions. As a consequence those indicators become of relevant importance within a “real-life” application of a life-cycle analysis strategy.