

Assessment of long-term structural reliability considering climate change effects

Pietro Croce, Paolo Formichi, Filippo Landi

Department of Civil and Industrial Engineering, Structural Division, University of Pisa, Pisa, Italy

Contact: filippo.landi@ing.unipi.it

Abstract

The assessment of climate change impacts is becoming increasingly relevant for many sciences and engineering disciplines. In this context, climate change may significantly affect the design of new structures and infrastructures as well as the long-term reliability of existing ones designed under the assumption of stationary climate.

A methodology for the assessment of climate change impact on long-term structural reliability is presented, based on the analysis of available information on past and future climate. The procedure relies on the factor of change approach and provide tools for the adaptation of climatic load maps and the evaluation of variations of failure probability and reliability index with time.

The proposed procedure will be illustrated for a relevant case study considering changes in climatic actions and different degradation conditions of structural resistance, which may also be affected by global warming.

Keywords: Climate change; structural safety; climatic actions; Eurocodes; long-term reliability.

1 Introduction

Climate change, its implications and potential future risks, are increasingly debated topics that involve various research fields and are becoming more and more relevant in many sciences and engineering disciplines, including civil engineering [1-3]. In fact, the potential increase in the frequency or intensity of natural hazards may significantly impact the design of new structures and infrastructures as well as the structural safety and reliability of existing ones [4-7].

The fundamental assumption of stationary climate, which is generally adopted for the evaluation of climate-induced loads, may not hold anymore due to the enhanced effects of climate change and suitable adaptation strategies [8-9] are thus

needed to build climate resilient buildings and infrastructures and to preserve the existing ones.

In this context, climate adaptation measures may include, for example, an enhancement of design standards but also retrofitting or strengthening of existing structures, as well as the utilization of new materials, and changes to inspection and maintenance plans [3].

The evaluation of potential impacts of climate change and the development of appropriate adaptation strategies is a challenging task which involve several research fields (climate and impact modelling, structural safety, risks management).

First, to assess impact for specific regions we should rely on available information on past and future climate. Climate services are now making