Load bearing capacity of corrosion damaged beams after exposure to severe marine environment during 70 years

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Summary

The partial demolition of a reinforced concrete (RC) industrial building that had been exposed to a severe marine environment since its erection in the nineteen forties provided an opportunity to conduct theoretical and experimental structural assessments on large-scale, naturally deteriorated members. Eight beams were specifically selected for this purpose. Theoretical assessments were performed to determine the internal stress in critical regions. The EN-1992-1-1 [1] and *fib* Model Code 2010 [2] (hereafter "MC2010") resistance models used were suitably adapted to factor in the effects of corrosion. This paper describes the experimental procedure and provides an example of a four-stage assessment conducted on one of the beams tested, designed to ascertain the effect of entering new input on its geometry and the properties of its constituent materials. The procedure described may be used in the safety assessment of existing deteriorated RC structures.

Keywords: large-scale members, natural corrosion, assessment of existing structures, data acquisition, resistance models.

1. Introduction

Structures must comply with serviceability and structural safety requirements to a suitable level of reliability, not only during the design stage but during their intended service life. Since physical, chemical and biological agents able to induce structural deterioration act simultaneously with mechanical forces, all actions and effects, including durability-related effects, need to be taken into account in a consistent way.

Structural safety verification calls for resistance models able to factor in deterioration. Corroded reinforced concrete structures strength depends, among others, on the remaining cross-section of the corroded reinforcement bars, the stress-strain diagrams of the materials, the concrete-reinforcement bond and corrosion-induced concrete cracking.

Studies have been conducted in recent years to develop resistance models that factor in deterioration processes, primarily corrosion. Their findings must be viewed with care, however, for the following reasons:

- In most cases, the specimens studied were exposed to accelerated deterioration, which may not necessarily be an accurate reflection of natural deterioration.
- The studies involved small-scale specimens cast under laboratory conditions. The suitability of these resistance models for larger members must, then, be verified.

In light of these shortcomings, the change of use of a nineteen forties RC industrial building in Spain exposed to a severe marine and industrial environment afforded a unique opportunity to study the performance of real, large-scale, naturally damaged members.

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