

Theory & Practice: Decay Patterns, Damage Processes and Conservation Approach of Historic Concrete

XII International Conference on Structural Analysis of Historical Constructions–SAHC2020

Pardo Redondo, Gabriel*, Lubelli, Barbara[†] and Naldini, Silvia^{††}

* Chair of Heritage & Architecture, department of Architectural Engineering + Technology
Technische Universiteit Delft
Julianalaan 134, 2628BL Delft, the Netherlands
e-mail: g.pardoredondo@tudelft.nl

[†] Chair of Heritage & Architecture, department of Architectural Engineering + Technology
Technische Universiteit Delft
e-mail: b. lubelli@tudelft.nl

^{††} Chair of Heritage & Architecture, department of Architectural Engineering + Technology
Technische Universiteit Delft
e-mail: s.naldini@tudelft.nl

ABSTRACT

Historic concrete differs from modern concrete not only in the design parameters, but also in materials and execution. In fact, the first uses of reinforced concrete were based on proprietary systems (Monier, Hennebique, etc.), which formulas and designs were kept under their own patents; besides, every country had also their own innovative systems (e.g. the use of *bricke-beton* and *schokbeton* in the Netherlands). Because of the try-and-error character of these initial attempts, a number of errors were made, both in the design of the concrete material and of the structure. Regulations and manuals to achieve more standardisation in reinforced concrete started to be produced only at the beginning of the 20th century, but, in general, it was not until the 1960s that reinforced concrete reached a similar quality as current concrete. Therefore, historic concrete buildings, because of their “experimental” character, require a specific approach to both survey and conservation, which may be different from that applied to modern concrete buildings.

The European JPI-CH project CONSECH20 (www.consech20.eu) has been set-up to fill up this lacuna. The project focusses on the assessment, intervention and monitoring of cultural heritage concrete buildings with the aim of developing an improved methodology for their conservation.

In the framework of this project, several historic concrete buildings have been studied in the participating countries (Cyprus, Italy, the Netherlands, and Czech Republic). A representative selection of cases was made taking into account period of construction, structural system, type of construction, current state of conservation, environment, and original and current use.

In this paper, the results of the survey carried out on case studies located in the Netherlands are presented. The survey comprised different phases: a historical study of each building, a qualitative visual inspection on type, extension and severity of damages, and, when it has been possible, additional non-invasive testing to determine concrete strength, reinforcement layout and sizes, carbonation depth, corrosion state, and chloride content.

Based on the results, decay patterns and related damage processes recurrent in historic concrete buildings are identified. The approach applied to the conservation of these buildings in the past, including both technical and social and management aspects, is critically discussed and suggestions for an improved methodology to approach the conservation of historic concrete buildings are proposed.