Engineering Failure Analysis 44 (2014) 36–45

Contents lists available at ScienceDirect

Engineering Failure Analysis

journal homepage: www.elsevier.com/locate/engfailanal

Assessing the durability of mortars tiles – A contribution for a prediction model

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ARTICLE INFO

Article history:
Received 31 January 2014
Received in revised form 8 April 2014
Accepted 17 April 2014
Available online 28 April 2014

Keywords:
Durability
Performance: Accelerated ageing tests
Natural ageing
Prediction model

ABSTRACT

The service life prediction of any construction material is not an easy task. The researchers must choose between several different approaches each of which have disadvantages and limitations. While in real buildings, with in-use conditions, the material or component is subject to changeable actions in an environment where the great majority of the degradation agents are not controllable by man, in a laboratory, we can choose to expose the material to artificial and controlled conditions, using chambers for accelerated ageing. The main difficulty of this last type of test exists in the interpretation of the results, in what concerns their correspondence to real time.

In this paper, a discussion on this subject is presented based on two experimental research works, concerning the performance over time of two different types of industrial cement mortars exposed to accelerated ageing tests and also to natural ageing. The main advances and the main difficulties in implementing a service life prediction model will be identified. Finally, suitable strategies are discussed for the future development of this approach.

1. Introduction

An efficient adhesive bonding of exterior ceramic tiles applied on façades is an obvious important factor to ensure the safety and the durability of the façade. The failure of adhesive bonding has immediate consequences and therefore is a common concern of the building industry and of building owners.

The objective of any service life prediction of a material or component integrated into a building is to evaluate its ability to satisfactorily perform its function throughout the service life of the building or throughout the period considered reasonable for its replacement or repair. The two experimental studies that are presented here use the same model of service life prediction applied to two types of different mortar, but lead to results whose interpretation differs. Therefore, a discussion is presented on the factors that could influence the service life prediction, on the structure of the model and on the possibility of its generalised application.

1.1. Service life prediction model

The two experimental studies carried out in the Building Physics Laboratory were based on the general methodology proposed by ISO 15686 [6] standard and lead to the proposal of the model that is presented. Test campaigns were carried

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http://dx.doi.org/10.1016/j.engfailanal.2014.04.027
1350-6307/

out for accelerated ageing, in a laboratory. Natural ageing stations were simultaneously set-up where the materials were exposed to the external environment and tested [5].

According to the diagram in Fig. 1, when in possession of the test results, referring to accelerated ageing and to natural ageing, given that the type of degradation resulting from either one or the other test is seen to be similar, it is possible to interpret these results and develop a model of service life prediction of the products and systems being studied through the establishment of a correlation between the number of cycles of artificial ageing and the real time of natural ageing (Fig. 2).

Knowing the degradation curve of a given characteristic (as an example, Fig. 2 considers the adhesive strength between a mortar and its substrate) it will be possible to establish a correspondence between the number of accelerated artificial ageing cycles and the number of years in real time.

1.2. Barriers to the model establishment

The model presupposes the identification of a degradation curve as a function of time, obtained in accelerated ageing tests. This procurement can be met with several difficulties. Firstly, the most relevant agents of degradation for the material

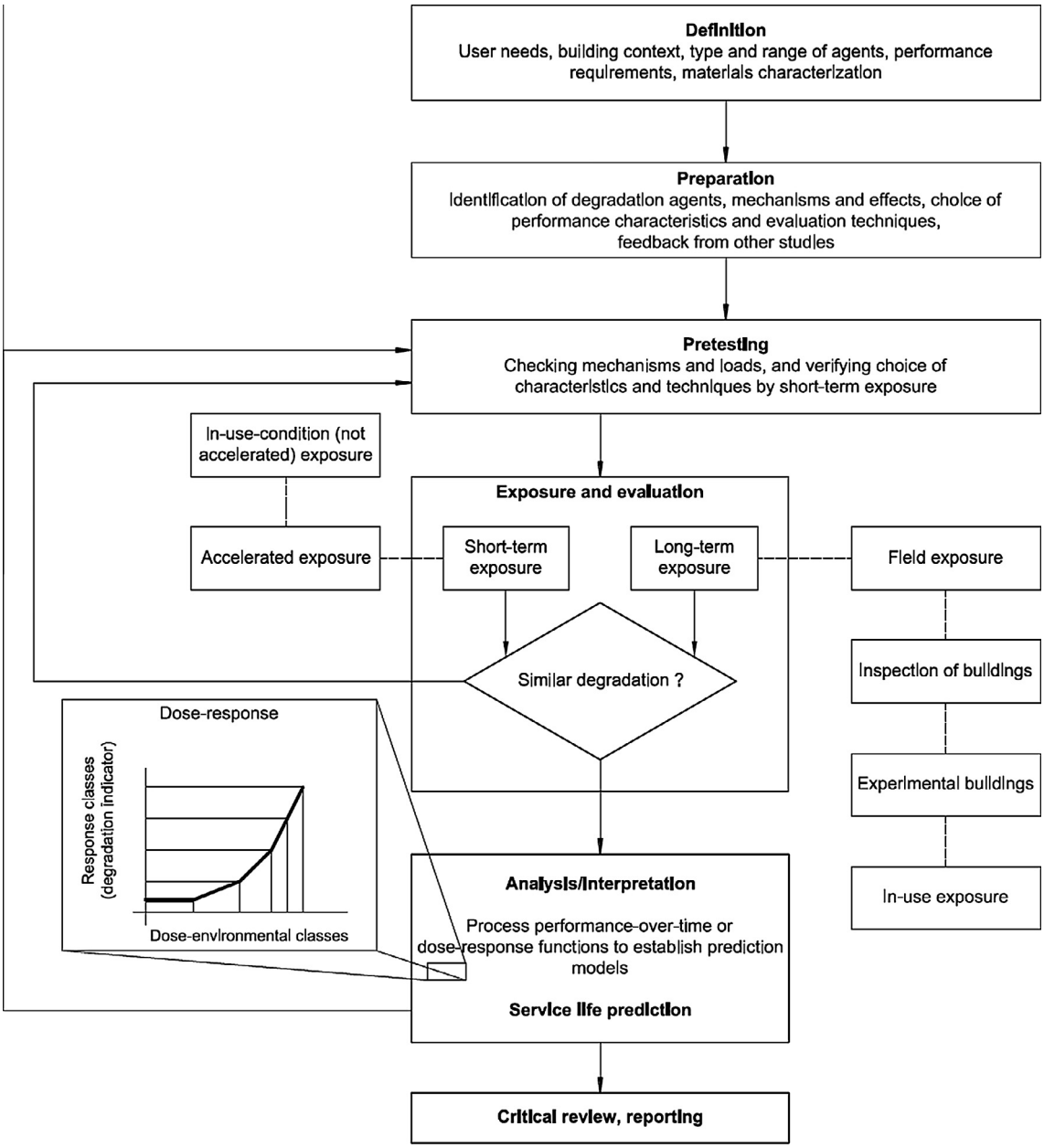

Fig. 1. Systematic methodology for service life prediction of building components (ISO 15686-2).