

Determination of the Deterioration Characteristics of Facade Materials: A Case Study

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Keywords: *Environmental Deterioration, Facade Inspection, Agents, Mechanisms, Durability.*

1 Introduction

Building components are expected to maintain their required performance levels over their service life. In order to succeed in this process, identifying the environment and the future cause of the deteriorations are a precondition. During the literature reviews, it is seen that facade materials such as granite, wood composite, aluminium, glass and ceramic are exposed to deteriorations as time progresses. In this study, the deteriorations formed at the façade of a case building and their causes have been explained systematically. Agents, mechanisms and effects of the deteriorations were identified. Results and expected damage are explained.

2 The Case Study

In this section, specific data, information and analysis of the front facade of the building are intended to provide a proper method for conducting the deteriorations. This section provides a draft of the proposed systematic approach to study that reflects on an individual understanding and perception of the research process. Macro environment analysis focuses on the continental observations consisting of location, orientation of the building, surrounding buildings, traffic and pedestrian roads and vegetation at the site. Meso environment analysis consist of climate type, dominant wind direction, temperature, precipitation, air content, pollution and soluble salts which influence the building. Micro environment analysis consist of age, height, architectural form, function, facade materials, material types, their characteristics and material structure system.

3 Analysis

For the case study, visual observations are made. Agents of deteriorations have been analyzed while making environmental analysis. 5 types of agents have been observed. These agents are grouped as; physical agents (temperature, moisture, light and wind), chemical agents (water, air, salts), biological agents (plants, birds, mold), design decisions, vandalism.

There exist 4 major typical mechanisms of deterioration, which lead to failure. These are grouped as; mechanisms caused by material properties, mechanisms caused by material structure properties, environmental mechanisms, construction related mechanisms.

A review of the causes of failure identified 12 of the most frequent sources of deterioration in facade materials are; dirt and dust accumulation, spalling, biological colonization, staining, corrosion, efflorescence, gypsum crust, cracks and breakage, discoloration, UV degradation, chipping, scratches. Agents, mechanisms and effects of the deterioration for each facade material can be seen in Table 1.

Table 1. Agents, mechanisms and effects of the deteriorations.

	Agents	Mechanisms	Effects
GRANITE	Wind	Pollution caused by traffic	Dirt and dust accumulation
	Moisture + wind	Salts on the surface	Spalling
	Mositure + wind	Cracks	Biological colonization
	Design decisions	Sun	Color changes
	Temperature	No gaps between the panels	Bowing and expansion
	Moisture	Panel joints	Staining
	Air + water	Panel joints	Corrosion
CERAMIC	Soluble salts	Adjoining parts of the ceramic	Efflorescence
	Design decisions	Air pollution	Gypsum crust
	Moisture	Shading areas	Mold growth
	Temperature	No gaps between the panels	Cracks and breakage
	Air + water	Panel joints	Corrosion
	Wind	Air pollution	Discoloration
WOOD COMP.	Biological agents	Water intake from the cracks	Weight loss of the material
	Wind	Air pollution	Discoloration
	Moisture	Absorption characteristics of wood	Damage
	Light	The color of the panels	UV degradation
ALU MINI UM	Air + water	Profile properties	Corrosion
	Design decisions	Sun	Color changes
GLASS	Wind	Design decisions	Breakage
	Birds	Structural problems	Chipping
	Human related	-	Scratches
	Moisture	Application failures	Discoloration

4 Results and Discussions

Since the building is only three years old, only the dirt deposition and the discoloration on the surface of the granites and discoloration on the WPC's caused by the rain have been observed. Expected deteriorations of the materials are discussed.

The method presented in this paper was developed as a tool for the prediction of the service life of building components. Deteriorations have been analyzed by a systematic approach using environmental analysis, visual observations and literature review. It is clearly seen that, deteriorations on the facade of the building will occur in the future.

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