

Structural defects in masonry

Towards a systematic diagnosis

RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES



Speerpunt
BOUW

Subject

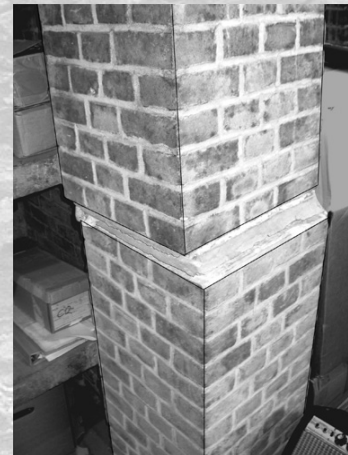
Insight into the cause of damage is indispensable for an adequate treatment of a defect, and for an optimal conservation of a building. However, the relation between the signs of a structural defect and its cause has not been defined unambiguously yet. This hinders an efficient approach to structural damage.

Goal

Aim is to support the diagnosis of structural damage by providing an overview of damage mechanisms. This overview will give better insight into how structural damage occurs, and how it can be identified and linked to its cause.

Expected Results

This project will result in an overview of unambiguous relations that link characteristic symptoms and contexts of damage to its cause. It intends to include clear guidelines and simple tests that can be used for investigating the cause of structural damage.



3TU.

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A diagnostic support for structural defects in masonry church buildings in the Netherlands

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Subject: Diagnosing structural defects

The assessment of a building with damage can be compared to the approach to a patient in health care. In both professions, the most important, but at the same time most difficult phase is the diagnosis. Insight into the cause of a defect is indispensable for the selection of an adequate treatment, or an optimal conservation strategy. However, in building pathology the relation between the signs of a structural defect and its cause has not been defined unambiguously yet. This hinders an efficient approach to structural damage.

Goals

This PhD research aims to enhance the diagnosis of structural damage, by providing a well-organised overview of damage mechanisms and how they can be distinguished. It has been triggered by the idea that the symptoms and context of damage give, in principle, sufficient clues to be able to deduce the cause of structural damage; however, that an objective guideline for the interpretation of these signs is still missing. Hence, this study systematically investigates how the symptoms of structural damage can be related to specific damage processes. Also, the influence of contextual aspects regarding material, geometry, and environment, on the initiation and propagation of these damage processes is being examined. The resulting damage mechanisms give insight into how damage processes function, and will thus help surveyors to better distinguish between causes.

Research Question

How can structural damage be unambiguously diagnosed from its symptoms and context, in masonry church buildings in the Netherlands?

Strategy

To systematically relate damages to their causes, the concept of a damage mechanism has been developed. This concept allows for an explicit description of all steps in the damage process, from root cause to damage pattern, including all material, geometrical, and environmental factors that influence these processes. Each component is inventoried, and the qualitative relations between them are examined. For two symptoms and two contextual factors, their relations to certain causes are also quantified with variation studies using the finite element program DIANA.

Expected Results

This project will result in an overview of unambiguous relations that link the characteristics of symptoms and context of damage to its cause. It intends to include clear guidelines and simple tests that can be used for investigating the cause of structural damage. Although the study is focused on masonry church buildings in the Netherlands, the use of this guideline is expected to be profitable for a wider field, both as a learning tool for novice surveyors, and as a support for experts.

Preferred Partners Applications / Sponsors

Monument care and heritage organizations, restoration architects and builders, owners and trustees of church buildings.

Prime Publication / Prototyping

The results of this research can be implemented in an instrument for diagnosis and assessment of structural failure, for both curative and preventive use in restoration practice.

Research Period

2006-2010