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## Status determination of a historical building including measures for three different scenarios

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### Abstract

Today there is a need for energy-efficiency measures in historic buildings. Clarifying both opportunities and risks for energy-efficiency measures in historic buildings is a challenging task. To ensure that such measures will provide the planned result without damage to the building or poor indoor climate, a skilled holistic approach is required. To be able to propose accurate measures requires a thorough understanding of the individual cultural heritage, the existing building's function and how the measures will affect the building. This requires a multidisciplinary knowledge, for example building antiquarian, building biological and building physical expertise. In this paper an example of a status determination and measures, including building antiquarian, building biological and building physical aspects is presented. Three different scenarios measures are assessed; same use as today, summer cottage, and permanent living.

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### 1. Introduction

Most of Scandinavia's historic buildings have undergone changes in design and usage. Older structures have been renovated with new construction solutions and materials. Changed requirements for indoor climate and energy use have led to installation of new heating and ventilation systems. The results of these changes have not always been

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satisfactory, and sometimes resulted in building damages of various kinds or a non-acceptable indoor climate (Mattsson 1995, 2011). These mistakes have led to extensive costs in damage remediation. In addition, in many cases important historical values are lost during the restoration work.

To implement energy-saving measures in existing buildings requires considerable expertise in a number of areas. A change into thicker insulation, intermittent heating, new types of building materials and reduced or modified ventilation affects the thermal and hygroscopic properties of the building. Unfortunately, it is usually the case that the sensitivity and thus the risk of for example moisture damage have increased by these measures (Mundt-Petersen 2013, Mattsson 2004). A number of structures, which we know is critical to moisture, will become even more sensitive, and new parts of the building, which previously functioned well, will be in the risk zone.

To be able to improve energy efficiency of an existing building in a proper way demands considerable expertise and holistic thinking of those involved. To handle the hygrothermal function of modern energy efficient buildings requires different types of computational tools and knowledge of the material properties. Energy update in existing buildings requires additional understanding of how the existing building works today. A status determination in a sufficient level of detail is of crucial importance in order to choose what measures should be considered.

From building owners and actors within the building antiquarian area there is a great demand for a methodology, including checklists and examples, to be able to consider building antiquarian, building biological and building physical aspects.

In this paper a newly developed method to assess building antiquarian, building biological and building physical aspects on energy efficient measures in historical buildings is presented and applied on a real historical building. Three different scenarios of use are assumed and measures proposed and discussed, taking into account the above-mentioned aspects, according to the different scenarios respectively.

The objective of this paper is to show the use of a newly developed method for status determination of historical buildings taking building antiquarian, building biological and building physical aspects into account when planning different energy update measures.

Effects due to actions in connection with the accessibility and fire safety have so far been neglected.

## 2. Material and Method

### *The 3B-method*

An early version of the “3B-method“ for status determination used in this example was presented in NSB2014 in Lund 2014, (Arfvidsson et. al, 2014). A very short summary is given here. To make an accurate assessment of risk requires knowledge in a number of disciplines. The method used here includes the expertise from building physicists, building biologists and building antiquarians. Together they will determine the status of the building in order to give a solid base for decisions. Each of the three areas has been treated in a similar way that makes it possible to handle them all within the same system. The systematics in the method is inspired from the ByggaF-method (Mjörnell et al. 2012), which is developed to assess the moisture safety in buildings though out the whole building process. The Building antiquarian (conservation consultant) deals with building technology, traditional building materials and heritage values. The care of the historically valuable buildings is governed by certain general principles and of special requirements and legislations, based on each building's individual cultural and technical characteristics. Some general guidelines are; preserving the character, using minimally invasive procedures, preventing damages, using traditional materials and traditional techniques.

The Building physics part deals with energy efficiency, moisture safety, ventilation and indoor climate, but also building technology. A number of checklists will be used to cover and assess the different building physical aspects.

The Building biological part deals with the presence of different kinds of fungi and insects. Examples of checklists have been designed to facilitate the possibility to assess the degree of attack and how dangerous it is but also the reason behind and the way to minimize the future effects (Mattsson 2010)

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