



## Reliability aspects of assessment and upgrading

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### Summary

In decision making related to assessment and upgrading of building structures many and large uncertainties have to be taken care of. The basic questions are: how safe is the structure, how safe should it be and, where relevant, which measure should be taken? In all these cases the answers may differ from those in the design situation. Another typical aspect of existing structures is that uncertainties can be reduced by incorporating results of inspection and monitoring. This, however, raises new questions about when, where, what and how to inspect. Authorities and politicians may be interested in long term costs related to inspection, maintenance and replacement. To deal with these matters, a risk based decision approach offers a perfect theoretical framework. Application in practice, however, is another thing and turns out to be far from trivial. There is a need for guidance and where possible simplification. This should lead to codes of practice in a similar way as for the design of new structures where historical pragmatic design rules are merged with a risk and reliability background.

**Keywords:** Reliability, risk based decisions, codes, existing structures, updating reliability, cost optimisation

### 1. Introduction

The assessment of an existing structure differs in a number of aspects from the design of a new one. Results of inspection and monitoring may give additional information with respect to the actual properties of the structure and the future developments to be expected. Decisions have to be taken whether or not to repair or strengthen the structure. The safety level to be maintained may also differ from the design situation if socio-economic considerations are taken into account.

Prenormative research in this field has been performed within various scientific groups and committees [1-5]. In many cases the focus has been on earth quake. At present a few countries have a formal code type document for the assessment of existing structures [6-14]. On the ISO level reference can be made to [15-17] and on the European level recently a group has been installed to prepare a Eurocode document in this field. In the present paper we will first deal with some specific issues from a theoretical risk and reliability point of view and then return to the code development topic later.

### 2. Target reliability for existing structures

In principle the assessment decision for an existing structure may be one of the following alternatives: