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Aspects of Reliability and Quality Management of Buildings in Accordance with Eurocode

K. A. A. A. Sanjery*, N. A. Rahman, K. S. Baharudin

Department of Civil Engineering, Kuala Lumpur Infrastructure University College
43000 Kajang, Selangor Darul Ehsan

Abstract

Malaysian construction industry follows the British Standards. Currently, the British Standards have been withdrawn and replaced by Eurocodes. In 2004, the Institution of Engineers Malaysia published a position paper on the concrete codes of practice in Malaysia after 2010 and recommended that the Eurocodes be adopted after the withdrawal of the British Standards. The structural Eurocode is undoubtedly a state –of-the art design code for structural engineering. Hence we have little choice except to adopt the current Eurocodes as Malaysian National Standards. However, it is permitted to attach a national annex with Nationally Determined Parameters (NDP) to the main body of the Eurocode New concepts and terminologies related to reliability and quality management have been introduced by the Eurocodes. This would to a certain extent affect engineering practice in Malaysia, and it will be the choice of the construction industry whether to adopt them or not. People concerned with the requirements of the Eurocode are: committees drafting standards; professionals; designers and constructors, clients (e.g. for the formulation of their specific requirements on reliability levels and durability) and relevant authorities. This paper will look into the aspects related to reliability and quality management proposed by the Eurocode and the respective comments given in the Malaysian National Annex. This covers definitions, basic requirements, measures and applications, and specific requirements on reliability and Iquality management. implementing the Eurocodes would require high standard of engineering practice and more time and understanding of the various aspects introduced. It is concluded that in order to produce safe and durable structure, all requirements of the Eurocode must be considered. Malaysia must take serious steps towards building a national reliability safety model. Issues related to liability and standard of care, in case of non compliance with the code requirements should also be addressed.

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*Corresponding author.
E-mail address: kousay@kliuc.edu.my

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1. Introduction

It has been long established that uncertainties in anticipated loads and load carrying capacity of a structure are inherent in structural design. These uncertainties can be put into two major categories with regard to causes of failure, these are:

a. Natural causes; result from unpredictability of loads such as wind, earthquake, water pressure, or live load acting on the buildings. Another source of uncertainty attributable to natural causes is the mechanical behaviour of the materials used in construction.

b. Human causes; include intended and unintended departures from optimum design. This includes approximation, calculation errors, communication problems, lack of knowledge, and greed. Similarly, during construction, uncertainties arise due to the use of inadequate materials, method of construction, changes without analysis. Misuse, inadequate maintenance, and sabotage can also be attributed to this category.

Due to this, Nowak and Collins [1], and Schneider [3] indicated that the complete structure will not be absolutely safe but always with a finite probability of failure. To minimize this probability, reliability - based design criteria approach has been developed and most of current codes are based on this concept. This approach intended to minimise the risk of failure due to both natural and human causes.

In this approach, numerical values for partial factors and other reliability parameters are recommended as basic values that provide an acceptable level of reliability. In addition, these values have been selected assuming that an appropriate level of workmanship and quality management applies.

This paper will focus more on the risk of failure due to non-compliance with items related to reliability and quality management. Accordingly, the items of the Eurocode related to aspects of reliability and quality management will be presented and discussed.

2. Structure of the Eurocode: EN 1990 Basis of structural design

There are 58 parts of the Eurocodes have been published by CEN (European - committee for Standardisation), classified as Normative References.

Department of Standards Malaysia published a draft copy of the following parts of the Eurocode which are related to buildings for public comments:

EN 1990 Eurocode : Basis of Structural Design [2]
EN 1991 Eurocode 1: Actions on Structures
EN 1992 Eurocode 2: Design of Concrete Structure
(EN: European Standard)

EN 1990 Eurocode covers all aspects of reliability and quality management and will be the subject of this paper. The code is applicable to buildings as well as all types of structures including reinforced concrete, steel, aluminium, and timber. It describes the principles and requirements for safety, serviceability and durability of structures and set approaches for proper design and execution procedures. The various items, as presented in the Eurocode EN 1990, relevant to the present study are given in the flow diagram shown in Figure 1.