

STRUCTURAL APPRAISAL OF EXISTING BUILDINGS, INCLUDING FOR A MATERIAL CHANGE OF USE

Part 1: Requirements for a structural appraisal

Stuart Matthews

This Digest gives guidance to professional engineers on the structural appraisal of existing buildings, including making a structural appraisal for a material change of use.

Part 1 considers the overall regulatory requirements, and in particular the disproportionate collapse issues associated with Requirement A3 of the Building Regulations Approved Document A: Structure. It describes what constitutes a material change of use and reviews the Building Classes (see Section 5 of Approved Document A: Structure). It also examines means of reducing sensitivity to disproportionate collapse in respect of Building Classes 2A, 2B and 3, as defined in Table 11 of Approved Document A. The provisions in the structural Eurocodes for reducing sensitivity to disproportionate collapse are also discussed.

1 INTRODUCTION

This Digest describes the general processes that may be applied when making a structural appraisal of many types of building and structure, but there is a particular focus on the requirements associated with making a material change of use to part or all of an existing building, as defined in Part 2 of the Building Regulations 2010⁽¹⁾ for England and Wales (hereafter 'the Building Regulations').

Although Scotland and Northern Ireland are governed by separate legislation, the general objectives and requirements are similar, but there



Figure 1: Intricate masonry façade of a Victorian building employing 'traditional' forms of construction

are subtle differences. For example, Scottish Building Regulation 12 concerning conversions poses more onerous requirements. The fundamental principles of structural appraisal described in this Digest, though, will be generally applicable in all three legislatures.

In the context of the Building Regulations, a structural appraisal in respect of a material change of use must assess compliance with the requirements of Part A, Structure, of Schedule 1 of the Building Regulations. The primary concerns are structural safety, strength and stability of the building under normal loads and actions (Requirements A1 and A2), as well as reducing its sensitivity to disproportionate collapse under accidental loads and actions (Requirement A3). In many

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Part 2: Preparing for structural appraisal

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This Digest gives guidance to professional engineers on the structural appraisal of existing buildings, including making a structural appraisal for a material change of use.

Part 2 introduces structural appraisal, and discusses the factors that might influence the outcome of an appraisal, and what might be involved in preparing for it. It looks at the many factors that can influence the structural behaviour and performance of buildings, including: through-life perspectives; cultural heritage issues; sources of hazard and risk; accidental loadings and actions; structural systems and materials; stability and resilience of buildings; loads and actions; verification criteria; safety considerations; material influences; defects, deterioration and damage mechanisms and sustainability issues.

1 INTRODUCTION TO STRUCTURAL APPRAISAL

A structural appraisal is undertaken to check the adequacy of an existing structure with respect to a current or future use. Often the scope of these activities may extend to making a prognosis of future behaviour and safety. Structural appraisal is therefore a process of gathering and evaluating information about the form and current condition of a structure and its components, its service environment and general circumstances, so that its adequacy for future service can be established against specified performance requirements, such as loadings, actions, or durability.

The art and processes of appraising an existing structure are different from those associated with



Figure 1: A modern building complex

designing a new building, where the flow of forces follows the choice of structural form and materials, and the procedures for structural analysis follow on. In design, the engineer can decide on appropriate means for satisfying issues of structural stability, load capacity, and serviceability. In appraisal, the engineer has to deal with an existing building or structure in which aspects of the structural form and the characteristics of the materials are established, but are generally much less well known. Although, notionally, these are definable qualities, depending upon the amount spent on the task, the appraising engineer must determine the condition of the existing building or structure and form an opinion on its suitability for future use in the envisaged circumstances.

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Part 3: Structural appraisal procedures

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This Digest gives guidance to professional engineers on the structural appraisal of existing buildings, including making a structural appraisal for a material change of use.

Part 3 describes structural appraisal procedures. It looks in detail at the process of structural appraisal: at the steps involved, and at the levels of activity. It then goes on to consider structural work needed for a proposed change of use, at health and safety issues, and at reporting on the outcome of the appraisal. Annexes to this Part cover ancillary aspects of the appraisal (safety concepts, partial safety factors, target reliability values), and residual service life estimation.



Figure 1: Looking up the facade of a terracotta office building

1 THE STRUCTURAL APPRAISAL PROCESS

1.1 Overview

The process of carrying out a structural appraisal of an existing building involves gathering information and evaluating it to understand the implications for the building's current and future use. This requires information already in existence for the building to be identified, collected and evaluated, along with the nature and extent of any additional information required to complete the task.

Ideally, the client would provide the engineer with a dossier of structural drawings and other documents, providing a complete description of the original structure

as built, and of any subsequent alteration and repair. More often, though, the engineer will have to search for appropriate information. Although the building can be used as the primary source of information (see Box 1 in Part 4 due for publication at the end of 2012), much effort and expense can be saved if documentary information can be obtained. A health and safety file, which would contain much of the desired information, should have been compiled for buildings constructed in the UK after 1994, but often this will not be available, or will be incomplete.

Even if such information is provided, the engineer should still check critical aspects of the data, as far as possible, by checking against evidence obtained from the structure by inspection, opening-up, or testing.

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Part 4: Additional considerations and information sources

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This Digest gives guidance to professional engineers on the structural appraisal of existing buildings, including making a structural appraisal for a material change of use.

Part 4 provides additional coverage on sources of information; on the characteristics of materials; on defects, deterioration and damage mechanisms (physical, chemical, biological, electrochemical and electromagnetic); and on through-life management in a low-carbon future (refurbishment of existing buildings, timing of decisions, through-life value, sustainability). It then looks to the future, with the extension of the Eurocodes to existing structures, and the influence of climate change.

An extensive bibliography provides references and sources of information on building regulation- and safety-related guidance, current design codes, previous standards and design guidance, general construction and building defects, renovation of existing structures, loading and actions, the various types of construction, appraisal of existing structures and structural load testing.

1 GATHERING INFORMATION

The gathering of information about an existing building can involve many sources. The documents and other details concerned with the design and construction of the building are a particularly valuable source of existing information. Section 1.3 in Part 3 of this Digest discusses the gathering and reviewing of existing documentation,

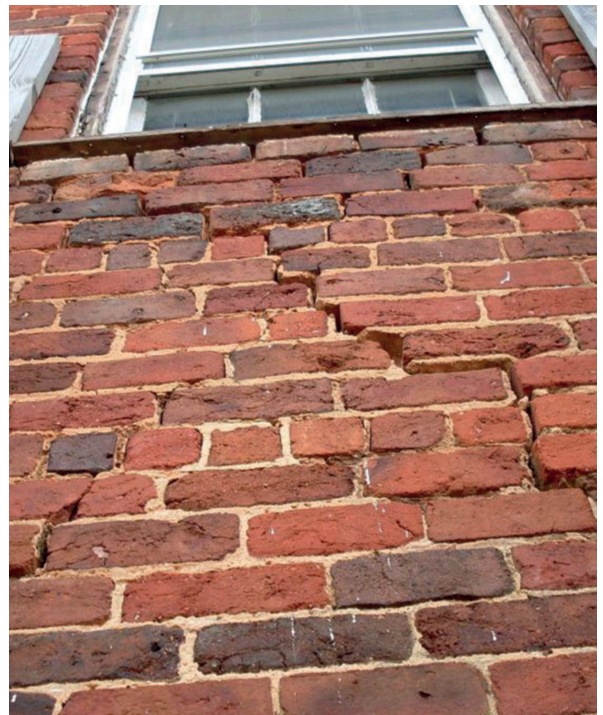


Figure 1: Diagonal cracking and damage to brickwork

and gives some basic guidance on such activities. Other useful sources include existing information relating to previous maintenance works and alterations to the building, reports on previous testing and investigation works (eg surveys, inspections, non-destructive testing) and activities such as structural load testing or other verification procedures. Personnel involved in such activities can also have relevant insights and recollections.