

Digest

Why do buildings crack?

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This Digest examines the causes of cracking in buildings and shows, with descriptions and illustrations, the visible results of a wide range of problems. The Digest is a key to other, more specialised, BRE Digests and other publications; however, it does not contain a complete solution to every cracking problem. It aims to broaden the understanding of the factors responsible and increase the likelihood of correct diagnosis and repair. Avoidance of some of the pitfalls will minimise future trouble in new buildings and lead to better design and workmanship.

This Digest was first published in May 1991. The factual content remains valid and this revised issue is primarily concerned with updating references.

1 Introduction

Most buildings develop cracks in their fabric. This often happens soon after construction when many materials are drying out; sometimes it occurs later. Most early cracking is not structurally significant but it may be aesthetically offensive and rain penetration may be increased. It is easily repaired and unlikely to recur to any great extent. Only rarely does cracking indicate a reduction in structural capacity. Much can be done to minimise, or even avoid, cracking by recognising that movement of building materials and components is inevitable and must be allowed for in design.

Diagnosis of specific causes of cracking is often difficult; every building is unique and several factors may combine to produce the observed defect. Before repairs or remedies are considered, the following must be ascertained:

- the causes of cracking
- their effect on the performance of the building
- whether movement is complete, incomplete or cyclic (eg seasonal).

Significance of cracking

Cracking can affect a building in a number of ways. If severe, it may result in a loss of stability, in rain penetration and air infiltration, heat loss and reduced sound insulation. All of these mean a loss in the efficiency of the building. Cracking may not be severe but it is often unsightly and unacceptable to occupants. Correct diagnosis will decide whether a satisfactory repair is possible or, in extreme cases, economically worthwhile and whether the requirement is only aesthetic or is necessary to maintain structural safety.

Digest 251 *Assessment of damage in low-rise buildings, with particular reference to progressive foundation movement*^[1] contains advice on the assessment of cracking and the appropriate action in relation to damage caused by ground movement. Digest 329 *Installing wall ties in existing construction*^[2] covers cracking due to wall tie corrosion.

The movements responsible for cracking are summarised in Table 1. The problems summarised in Table 1 are illustrated either by typical examples or by an expanded explanation.

2 Extent of movement

With most building materials, the normal cyclic (reversible) movements arising from seasonal or diurnal moisture and temperature changes will give a maximum movement of between 0.25 and 0.5 mm per metre length. Non-porous materials, such as metals, glass and most plastics, are affected only by temperature; porous materials, such as brick, concrete and timber, are affected by moisture as well. Timber has a very high moisture movement across the grain. Some plastics have very high thermal movements; they may also be swelled by solvents.