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## The structural adequacy and durability of large panel system dwellings: summary of the report



In October 1984 the Minister for Housing and Construction announced that the Building Research Establishment (BRE) would undertake a programme of investigations of dwellings constructed from large panel systems (LPS). This publication is one of a series resulting from those investigations and is intended to assist local authorities and their consultants in appraisal of LPS dwellings. It summarises the principal findings, conclusions and recommendations of the BRE report on the structural adequacy and durability of LPS dwellings.

### INTRODUCTION

Part 1 of the report describes the investigations of structural adequacy and durability of large panel system dwellings, and Part 2 gives general guidance on the appraisal of such dwellings. Research related to these investigations is continuing, particularly in relation to accidental loads such as those which may arise from explosions or fire. Further guidance, therefore, may be developed for assessing the sensitivity of LPS dwellings to accidental loads.

### INVESTIGATIONS OF CONSTRUCTION

The principal findings and conclusions from BRE's own site investigations and from an analysis of private-consultants' reports are given below.

No major structural failure of an LPS building in the United Kingdom has been reported since the programme of appraisal and strengthening of LPS buildings was carried out following the collapse at Ronan Point in 1968.

The Building Research Establishment has found no LPS building showing signs of structural distress sufficient to give concern for the safety of people; nor has it received any reports of an LPS building failing to sustain the loads experienced in service, including fire loading.

The quality of the reinforced precast concrete components in LPS buildings examined by BRE has been found not to be significantly better or worse than that of precast components in other forms of construction of the period.

A number of variations from original designs and specifications have been found. Their occurrence and extent does not conform to any identifiable pattern, nor are they confined to particular types of LPS building or periods of construction. Assessment of the implications of any such variations can therefore only be made satisfactorily on the basis of a structural appraisal of each individual LPS building. However, the information on specific types of LPS building given in Part 1 of the report may be a useful guide to identifying variations which may be present in particular buildings.

Limited departures from the original design and specification in building construction are normally accommodated by the margins of safety provided by the standards and codes which applied at the time of construction. However, some variations found in these investigations may have implications for the structural adequacy of particular LPS buildings in respect of their performance under normal or accidental loads, and for their durability.

Cracking and spalling of concrete arising from corrosion of reinforcement in the external envelope, eg cladding panels, have been found in a substantial number of LPS buildings. There is likely to be an increasing incidence of cracking and spalling, especially where components:

- (a) are exposed to wet conditions,
- (b) are of poor quality,
- (c) have inadequate depth of cover to the reinforcement,  
or
- (d) contain high levels of chlorides.

Thus there will also be an increasing likelihood of hazards arising from falling debris around some buildings unless they are inspected and maintained to prevent such incidents.

Corrosion of reinforcement in wall or floor panels or in the connections between them is unlikely to present a risk to the stability of LPS buildings unless it becomes substantial and widespread. Corrosion of reinforcement in connections between walls and floor panels or between walls and cladding panels will be minimised by maintaining them in a dry condition.

#### GUIDANCE ON APPRAISAL

The principal recommendations in Part 2 of the report, concerning appraisal of LPS dwellings, are based on the findings reported in Part 1 and on experience of appraisal of other building types. The recommendations are:

- 1 All LPS buildings required to exceed 25 years' service life from the date of construction should be subject to full appraisal for structural safety and durability.
  - (a) For buildings of 5 or more storeys (including basement storeys, if any), the appraisal of safety should be made with respect to both normal and accidental loads.
  - (b) For buildings of less than 5 storeys (including basement storeys, if any), the appraisal of safety should be made with respect to normal loads, ie stability under dead, imposed and wind loads and thermal and ground movements. (Proper provision for stability under normal loads will provide sufficient robustness in the event of local damage.)
  - (c) For all such buildings, visual inspections of the external envelope, including parapets, balconies, etc, to identify potential hazards from falling debris, should be made at intervals of 1, 2 and 5 years following the initial appraisal and subsequently at minimum intervals of 5 years.

- 2 All LPS buildings not required to exceed a 25-year service life from the date of construction should be subject to a visual inspection of the external envelope to identify potential hazards from falling debris, and should be screened for chloride content if the potential maintenance burden within this period is of concern.
- 3 A technical log should be established and maintained for all LPS buildings required to exceed 25 years' service life from the date of construction. This should contain detailed records of design details, history, assessments and modifications.

**This paper summarises the BRE Report entitled** The structural adequacy and durability of large panel system dwellings. **Parts 1 and 2 of the report are not available separately. It can be bought from: Publications Sales, Building Research Establishment, Garston, Watford, WD2 7JR, for £30.00 (post free). Please make cheques payable to 'Department of the Environment'.**

#### Other BRE publications on large panel system dwellings are:

**Building Research Establishment. The structure of Ronan Point and other Taylor Woodrow-Anglian buildings.** BRE Report. Garston, BRE, 1985.

**Edwards M J.** Weatherproof joints in large panel systems: 1 Identification and typical defects. **BRE Information Paper IP8/86** Garston, BRE, 1986.

**Edwards M J.** Weatherproof joints in large panel systems: 2 Remedial measures. **BRE Information Paper IP9/86** Garston, BRE, 1986.

**Edwards M J.** Weatherproof joints in large panel systems: 3 Investigation and diagnosis of failures. **BRE Information Paper IP10/86** Garston, BRE, 1986.

**Edwards M J.** Weatherproof joints in large panel systems: 4 Flat roofs, balconies and deck accessways. **BRE Information Paper IP15/86** Garston, BRE, 1986.

**Harrison H W, Hunt J H and Thomson J.** **Overcladding external walls of large panel system dwellings.** BRE Report. Garston, BRE, 1986.

**Morris W A and Read R E H.** Appraisal of passive fire precautions in large panel system blocks of flats and maisonettes. **BRE Information Paper IP18/86** Garston, BRE, 1986.

**Reeves B R.** **Large panel system dwellings: preliminary information on ownership and condition.** BRE Report. Garston, BRE, 1986.

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