

Research Priorities - Sheffield

Robustness must be a key theme.

- The avoidance of disproportionate collapse is important in the context of all types of hazard loading. It has already been recognised, albeit inadequately, in design codes for earthquake, impact and explosive loadings.

- More specifically:

- 1 Joints have obvious potential for failure under increased loading, force combinations which do not occur under normal conditions, or reduced strength at high temperatures.

2 Redistribution of internal forces within buildings of different types under thermal and force loadings needs to be better understood so that critical scenarios can be considered in design.

3 Local damage due to other hazard loadings and its combination with fire.

Limit State Design.

- One of the Holy Grails of performance-based structural fire engineering research is to bring fire resistant design into the spectrum of limit states for which structures are normally designed. This will mean that the fire limit state contributes to the structural solution at all stages of the process including the conceptual stage.
- Elements of this are:

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1 Acceptance criteria for fire resistant design need to be established for the different domains of Structural Resistance, Integrity and Insulation. The effect of deformations on the integrity of slabs is one aspect of this.

Criteria will differ for different types of building.

2 A risk-based approach to the development of safety factors.

Testing Facilities.

- Current structural fire testing, apart from the now-defunct Cardington facility, is restricted to a very much smaller scale than that of contemporary structural framing systems. Manufacturers and designers of new systems need to test them at a representative scale. There is a need for at least one facility for fire-testing of long-span systems such as composite cellbeams and composite trusses.

Structural Modelling

- The appropriateness of different modelling assumptions and capabilities to different types of situation needs to be assessed and clarified for practitioners. These need to be associated with the establishment of validation tests.

Effects of deformation on compartment walls.

- These include the failure of lightweight partitions, but may involve very different effects in residential construction using masonry.

Effects on new structural systems

- For example, deep-deck long-span slabs, whose rib reinforcement will heat rapidly in fire. In the absence of secondary beams such systems may suffer real local collapse.

Material and Structural Properties of Concrete

- ... about which there is still plenty of ignorance despite long-term research. Issues which need to be addressed in ways which produce usable results are Load-Induced Transient Strain and its effects on prestressed systems, spalling and the behaviour of fibre-reinforced concrete.

Masonry.

- Refer to Ali Nadjai.

Fire Spread

- ... and its effects on structural behaviour, including modelling of the effect of sprinkler action and the possibility of utilising sprinklers in the design strategy.

Thin-walled Sections.

- These are becoming increasingly important in domestic construction systems.

Refuge areas.

- Particularly the development of resilient structural systems.

Forensic Data.

- Research is hindered by the lack of available structural data from accidental fires. The few which are documented (Broadgate ...) have been extraordinarily valuable. A system needs to be established for collecting and documenting this data.