

## Construction Industry Council CDM Designers' Guides

Designing to make management of hazards in refurbishment work easier

## Technical Guidance Note

# T 20.005

### INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with refurbishment work.
2. Refurbishment figures prominently in HSE statistics as an industry in which accidents happen. Many of these accidents would have been avoided, if the right decisions had been made at the design stage.
3. Refurbishment work often exposes workers to the hazards associated with demolition. In addition, the stability of a structure during refurbishment often depends on the load carrying capacity of existing structural elements, some of which are very old or have had their sections reduced, i.e., weakened, to accommodate the new scheme.
4. Another significant factor is that refurbishment work is often carried out in or close to areas where the public are likely to be, exposing them to the risks associated with refurbishment. Therefore, great care needs to be taken by designers and contractors, to ensure that refurbishment work is carried out safely.

### HAZARDS ASSOCIATED WITH REFURBISHMENT

5. The main hazards associated with refurbishment work include:
  - a) Uncontrolled collapse of the structure or part of the structure during:
    - i) Demolition and dismantling, and
    - ii) Rebuilding;
  - b) Exposure to substances harmful to health;
  - c) Falling from height;
  - d) Working on confined sites.

### WHAT DESIGNERS SHOULD DO

6. Designers can help by eliminating these hazards completely or by designing to ensure that they minimise the chances of the hazard occurring.

#### Preliminaries

7. In order to assist with this, designers should find what they can about the building or structure to be refurbished, or advise clients that they have a duty to do so. Such information is available from a number of sources - see Table 1 in Technical Guidance Series **T 30.001 Demolition**. In addition, surveys of the existing building should be carried out.
8. The information referred to in 7 should, at least, include information about:
  - a) *The age of the building*: which should indicate whether a design code existed, when the building was designed. A chronology of design codes for some common structural materials is given below, in table 1. These standards will provide information about design techniques and assumptions and material strengths, which prevailed during their currency.

Table 1: Chronology of design codes and standards

Steel	<b>BS 449</b> : 1932, 1948, 1959 & 1967 <b>BS 5950</b> : 1985 & 1990
Concrete	<b>CP 114</b> : 1957 & 1969 <b>CP 110</b> : 1970 <b>BS 8110</b> : 1985
Masonry	<b>CP 111</b> : 1948, 1964, 1970; <b>BS 5628</b> : 1978

- b) *Building structural form*: This is necessary to allow a full analysis of the existing structure to determine:
  - i) Load paths,
  - ii) Individual member or frame loadings,
  - iii) How the new infrastructure could relate to or may be supported by the existing,
  - iv) Whether there is any pre-stressed or post-stressed concrete construction present, and
  - v) Whether solid masonry walls are, in fact, solid
 Knowing the construction techniques of an era would help this, because this could affect the design of the refurbishment. This information can be found by reading some of the books referenced at the end.
- c) *Building condition*: to allow an assessment of how much of the original load capacity is still available. In addition, this could alert designers to faults like:
  - i) Dry-rot in timber;
  - ii) Carbonation of concrete;
  - iii) Corrosion of steel, etc.
 In addition, this should provide information about construction methods that should not be specified – see **13**.
- d) *Materials of its construction*: to assist with -
  - i) Deriving the design strength of the existing structure; and
  - ii) Decisions about what processes may be applied to the materials, to ensure that these processes do not release harmful by-products – see General Guidance Series **G 030.001 What Designers Should Know**.
- e) *Any requirements for testing*: to provide credible assessments for strength and composition.
- f) *Building past uses*: which will indicate what substances harmful to health are present - see General Guidance Series **G 30.001** and Health Guidance Series **H 10.001 Hazardous Materials**;
- g) *Any site Restrictions*: which could control what can be delivered to site and lifted – see **19 a)** or manhandled – see **19 f)ii)**.

9. For buildings constructed before 1985, an asbestos survey must be carried out.

#### Designing to avoid uncontrolled collapse during small-scale demolition or dismantling

10. To avoid uncontrolled collapse, designers should ensure that individual members and existing structural systems are not overloaded by:

- a) Making sure that the global and component strengths of the existing structure are calculated;
- b) Determining what of the existing structure is critical for ensuring stability, to ensure that these components or structural systems are either not removed or removed only after specially designed temporary works are in place;
- c) Highlighting these members and systems **unambiguously** on a drawing and informing the contractor about the loads the temporary works will support, eg: when removing load-bearing walls;
- d) Informing the contractor about residual strengths in existing members, eg: floors, which could help a contractor to determine how much load can be applied to them – see also 9a) (iii) and 9b) (iii).

#### Designing to avoid uncontrolled collapse during rebuilding

11. To avoid collapse while rebuilding, designers should ensure that the forces applied during construction do not exceed the capacity of the existing structure, especially:

- a) Where stability depends on the interaction between the existing structure and the new components, eg:
  - i) Can the existing structure carry the loads applied by any new structure?
  - ii) Where roof trusses are being retained, what temporary bracing is required?
  - iii) Where temporary works are to be supported on the existing structure, eg: props on existing floors;
  - iv) Where construction loads could be significant, and could require careful control during erection, eg: rate of pouring concrete.

12. Wind during construction, eg, voids in facades can have a significant effects, and should be considered.

13. New work carried out close to an existing structure should be designed taking account of the stability of the existing structure eg:

- a) Underpinning should be carefully detailed and sequenced;
- b) Excavations should not undermine existing foundations;
- c) Driving piles should not affect fragile facades;
- d) Temporary works equipment should not affect the stability of existing structures.

#### Designing to avoid exposure to substances harmful to health

14. In existing buildings, many harmful substances may already be present from previous specifications.

Typically, the following may be found in old buildings:

- a) Lead, in paint;
- b) Arsenic, in wood preservatives;
- c) Asbestos – see Health Guidance Series **H 10.002, Asbestos**;
- d) Horse-hair in plaster;
- e) Combustion by-products in chimney flues.

15. The design should not specify processes, which may release the potential for harm in these materials, eg, grit-blasting lead paint. Any uncertainties about what to do about what has been found should be discussed with someone competent.

16. Neither should the new design specify materials nor assemblies, which could be:

- a) Harmful to health, eg, solvent paints –see General Guidance Series **G 30.001 What Designers Should Know**; and
- b) Unsafe to work on or near, eg, fragile materials.

17. Knowledge about previous building use may provide information about biological and other hazards that may be present, eg, toxic metals.

#### Designing to avoid falls from height

18. This usually occurs where workers are required to work near unguarded edges or newly created openings in floors and external walls. This is illegal and its control is the responsibility of contractors. However, where possible, designers should prevent these situations occurring. Where it is unavoidable, they should consider the requirements for the provision of PPE [work restraint], while these openings are being created and for protecting the open edges [barriers or coverings] afterwards - see Technical Guidance Series **T 20.008 Working at Height** and **T 20.007 Use of PPE**.

#### Designing to facilitate work on confined sites

19. Where refurbishment projects are carried out on congested sites, eg: town centres, inside buildings, etc, site work could be constrained by other considerations, eg: the need to ensure traffic flows and pedestrian movements. Therefore, designers should:

- a) Restrict members to sizes, which can be lifted by a crane that can fit within the site constraints;
- b) Restrict the weight of members, which have to be manhandled into location and position, eg: in existing buildings. For example, a UB could be designed to be:
  - i) Replaced by 2 × lighter RSCs back to back; or
  - ii) Erected in parts and spliced on site.Information on manual handling is given in General Information Series **I 001 Manual handling**.
- c) Allow as much off-site prefabrication as possible;
- d) Minimise construction loads, eg, by specifying composite construction, lightweight partitions;
- e) Require processes, which can be carried out by plant that can operate within the confines of the site, eg: mini-pilers in basements;
- f) Restrict the lengths of components to fit in with:
  - i) The size of delivery vehicle that can be used;
  - ii) Manhandling within an existing buildings, eg, around corners, along corridors, etc.

#### USEFUL REFERENCES

**SCI Publication 138** - Appraisal of Existing Iron and Steel Structures : The Steel Construction Institute;

**CIRIA report C579** – Retention of masonry facades, best practice guide;

**Appraisal of existing structures** [2<sup>nd</sup> edition] Institution of Structural Engineers

**BCSA Publication 11/84** Historical Structural Steelwork Handbook

**Building Construction and Drawing** CF Mitchell [BT Batsford Ltd]

**BRE Digests** - Various