examine methods by which the structure might be built, and analyse the hazards and risks associated with these methods in the context of his design choices'.

Even less attention has traditionally been paid to the use, maintenance, repair and demolition of a structure. Consideration of the risks arising from these activities now forms one of the designer's obligations.

The designer also has significant influence in the specification of components. Note that specification falls within the definition of design, according to the regulations. The regulations require that the selection of materials, equipment etc. is given similar attention to that of the construction method itself.

5.3.2 Risk assessment

Having identified the risks associated with a project, risk assessments must be carried out so that their relative importance can be established and appropriate actions identified. A plethora of systems is available to assist the designer in risk assessment. The Health and Safety Commission[40] illustrates a simple example, based on a subjective assessment of the likely severity of harm, combined with the likelihood that harm will occur. This example is represented in Table 5.1. A 'severe', 'frequent' risk should prompt serious consideration of design changes.

Table 5.1 ***Categories of likely severity and likelihood of occurrence of risks***

	Likely severity	Likelihood of occurrence
High	fatality, major injury, long-term disability	certain or near certain to occur
Medium	injury or illness causing short-term disability	reasonably likely to occur
Low	other injury or illness	rarely or never occurs

5.3.3 Avoid, reduce, protect, inform

Having identified risks, and where appropriate demonstrated by means of a risk assessment their importance, the designer should follow the hierarchy given below when dealing with them:

- avoid the risk
- reduce the risk by combatting it at source
- protect people (workers and public) from the risk
- inform others of a risk which will need to be controlled.

To illustrate this hierarchy consider the example of plant which is to be located on the roof of a building. Certain risks are associated with installing and maintaining this plant. The first option for the designer is to consider whether the risks can be avoided, namely by locating the plant at a lower level. If this cannot be done, he should consider reducing the risks, for example by using low maintenance plant which will reduce the frequency of operations at roof level. If neither of these two options is feasible, he must consider protecting from danger the men who will install and maintain the plant. He could do this by providing suitable access (walkways and handrails). For this example it is difficult to imagine that the

designer could not at least do something to provide protection, even if he were unable to avoid or reduce the risk. However, if this was not possible the least the designer would have to do would be to inform the client of the need to control the risks associated with plant installation and maintenance (for example by stating in the Health and Safety File (see below) that special measures will need to be taken during plant maintenance).

Health and Safety Plan

Within the context of informing others, it may be desirable to provide certain information on health and safety issues in the contract drawings, bills of quantities etc. The regulations also require the preparation of a *Health and Safety Plan*, containing:

- a general description of the work
- details of the proposed programme for the work
- details of the risks to be encountered during construction
- information so the contractor may allocate sufficient resource to the control of construction risks
- information which it would be reasonable for a contractor to know in order to comply with any statutory provisions or in respect of welfare.

Health and Safety File

The second repository for information required by the regulations is the *Health and Safety File*. The purpose of this file is to assist persons carrying out maintenance or construction work on the structure at any time after completion of the initial construction (for example modification, demolition). The ACoP suggests that the file may include:

- 'as built' drawings
- details of the construction methods and materials used
- details of equipment and maintenance facilities
- maintenance requirements and procedures
- details of the location and nature of utilities and services, including emergency and fire fighting systems.

5.4 Designer's response

Many hazards exist, the majority of which are independent of the construction material([41]). However, the structural designer's response to some common, generic hazards are considered in detail in the Sections that follow.

5.4.1 Frame/member instability

The frame or certain members may be unstable in the temporary state. Typical examples of this include:

- a frame which relies on other permanent works (for example concrete elements) for stability. Often these other works are not complete at the time when the frame is to be erected
- rafters which have no restraint until the permanent roof decking is fixed.