

# AN ASSESSMENT OF FACTORS INHIBITING DESIGNERS FROM COMPLYING WITH HEALTH AND SAFETY REGULATIONS IN THEIR DESIGN

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The construction (Design and Management) Regulations 1994 (CDM) place an important duty on designers to consider the health and safety of the workforce by designing out and minimising risks associated with the construction, maintenance and demolition of a building. Despite the specific duties imposed by the regulations on designers, statistics by the Health and Safety Executive (HSE) reveal that two-thirds of designers did not take them into consideration when working on their designs. This study aims at addressing the root cause of this by assessing the designers' level of awareness, understanding and expected commitment to the CDM regulations. In addition, the study seeks to determine the specific aspects of the regulations that designers have not been taking into consideration and the factors inhibiting compliance with health and safety regulations. The study was conducted through a questionnaire survey of UK construction designers and other construction industry participants. Results showed that whilst most respondents claimed to be fully conversant with their duties under the CDM, many indicated that the regulations require some clarifications as unspecific wordings in many cases means that the regulations are open to interpretations. Results further showed that inadequate time to explore design alternatives and budget constraints imposed by the client significantly inhibit designs from being able to comply with health and safety regulations at the design stage.

Keywords: CDM regulations, designers, health and safety, UK.

## INTRODUCTION

Health and safety is of fundamental importance on a construction site due to the nature of the work involved. According to the Health and Safety Executive (2002), construction workers are six times more likely to be killed at work than those in other industries. According to Broughton (2003), about 437 people were killed on construction sites in the UK between 1998 and 2003, of which about 225 were due to falls from height. Pitched against this background, it is evident that everyone working on a construction project, from the client to the site operative has a responsibility for health and safety. Yet, it is often assumed that the main contractor is solely accountable should any accident occur. In order to integrate health and safety throughout the life of a project and apportion responsibility between the various parties involved, the Construction (Design and Management) Regulations 1994

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(CDM) were introduced. The regulations aid coordination of responsibility by imposing legal duties on each party in order to mitigate risk as far as possible.

## **ACCIDENTS ON CONSTRUCTION SITES AND DESIGNERS' RESPONSIBILITIES UNDER THE CDM REGULATIONS**

Investigations and research conducted by the Health and Safety Executive (HSE) has revealed that, although the number of construction fatalities has seen a long-term decrease after the introduction of CDM, a rise of 23% was witnessed in the year 2000/01. There has also been a significant rise in the number of major injuries suffered by construction workers. Edwards and Nicholas (2002) emphasise the construction industry's poor accident record and state that "despite the intervention of government and European legislation" accidents continue to occur.

Williams (2001) raises the argument that the increase in accident figures may not necessarily be due to an actual increase in accidents, but has been caused by the introduction of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR). RIDDOR imposes a statutory duty on anyone in control of work premises to report to the HSE any work related accidents and dangerous occurrences; therefore a greater number of accidents are being recorded. Indeed, there has been a considerable increase of 41% in the number of accidents between 1995/96 and 1996/97.

Nevertheless, in light of the apparent continuing poor accident record within the construction industry, and as a result of the call for improved health and safety performance from The Construction Health and Safety Summit 2001 (HSE 2003c) published a Discussion Document setting out ideas for improvement and change. It aims to increase awareness, provoke discussion, and encourage initiative within the industry in order to improve the health, safety and welfare of the workforce. The document is targeted at everyone connected with the construction industry in the UK and highlights the need to change attitudes to health and safety in order to prevent accidents (HSE 2002). It identifies how those involved in construction are failing to effectively address health and safety issues, and advises that designers have a fundamental duty to reduce risks at an early stage during the construction process.

Hetherington (1995), Suraji and Duff (2001) agree that designers have an important role to play in the elimination of construction site hazards. Designers have the ability to change the designs before work begins on site so that "risks can be tackled at source" (Hetherington, 1995). Suraji and Duff (2001) stress the importance of designers adopting "design practices and guidelines aimed at improving safety during the execution of a project".

The CDM Regulations were introduced as the UK's response to the EU's "Temporary and Mobile Construction Site" Directive, which sought to improve the working conditions of building site workers (Cheetham, 2000). The requirement for the CDM Regulations according to Cheetham arose from "the unacceptably high rate of death, injury and ill health associated with all types of project". The regulations recognise that many important decisions affecting site safety are made long before work begins on site (Caldwell 1999), and the regulations aid the co-ordination of responsibility for health and safety by imposing legal duties on each party involved, in order to mitigate risk as far as possible from the early stages of a project. The regulations apply to any

form of construction work; including new build, demolition, renovation, maintenance and temporary works, that meets one of the following criteria (Perry 2002):

- it lasts for more than 30 days,
- it involves, or is expected to involve, more than 500 person days,
- it involves more than 4 people at work at any one time carrying out construction work, or
- involves any demolition or dismantling works.

Prior to the introduction of the CDM Regulations, designers had an implied duty under the Health and Safety at Work, etc Act 1974 to ensure that their designs did not expose construction workers to risks (Croner 1998). The CDM Regulations stipulate more specific requirements of designers regarding health and safety. The regulations place an important duty on designers to consider the health and safety of the workforce by designing out and minimising risks.

The CDM Regulations define a ‘Designer’ as:

“any person who carries on a trade, business or other undertaking in connection with which he:

- (a) prepares a design, or
- (b) arranges for any person under his control to prepare a design”

‘Design’ is defined as including “drawing, design, details, specification and bill of quantities in relation to the structure”. As a result, the role of designer not only includes architects, but also building surveyors, engineers, quantity surveyors, contractors, interior designers, and even the clients themselves. The duties imposed on designers as laid out in the CDM Regulations are as follows:

- (a) “to avoid foreseeable risks to the health and safety of any person at work carrying out construction work, or cleaning work, at any time” (Regulation 13 (2)(a)(i))
- (b) to combat risks at source (Regulation 13 (2)(a)(ii))
- (c) to give priority to measures which protect the whole workforce rather than the individual (Regulation 13 (2)(a)(iii))

## **DATA AND METHODOLOGY**

Data for the study was obtained through a questionnaire survey of Central London-based practitioners. In order to gain a balanced view of the subject matter, the questionnaire survey was targeted at a selection of designers, planning supervisors and multi-disciplinary practitioners, using a stratified random sampling technique. The names of designers and their addresses were obtained from the Royal Institute of British Architects’ (RIBA) directory of practices, available on their website ([www.architecture.com](http://www.architecture.com)). Details of planning supervisors were taken from the directory of practices published by the Association of Planning Supervisors, available on their website ([www.associationofplanningsupervisors.co.uk](http://www.associationofplanningsupervisors.co.uk)). Planning supervisors who had prior experience with ensuring that designers carried out their responsibilities correctly were included in the survey. A total of 100 questionnaires were distributed, out of which 46 responses fit for analysis were received. This represents a 46% response rate, which is quite high when compared with the norm of 20-30% response

rate in most postal questionnaire survey of the construction industry (Akintoye and Fitzgerald 2000). Table 1 shows the profile of responses to the questionnaire survey.

**Table1:** Responses to questionnaire survey

Respondents' designation	Number of responses	Percentage of responses	Cumulative percentage
Designer/Architect	21	45.6	45.6
Project Manager	8	17.4	63.0
Planning Supervisor	9	19.6	82.6
Building Surveyor	8	17.4	100.0
Total	46	100.0	

The questionnaire relates to the CDM regulations; aiming to find out respondents' views about the regulations, and whether they were aware of the duties the regulations imposed on them. The questionnaire also identified some factors thought to inhibit designers from complying with the health and safety regulations. Both of these issues were investigated by asking respondents to provide opinions on a Likert-type scale of 1 to 5. Responses were analysed using the mean analysis, which were subsequently ranked in order to determine relative importance of factors considered. The mean score is determined as follows:

$$\text{Mean Score} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{(n_5 + n_4 + n_3 + n_2 + n_1)} \quad (\text{Equation 1})$$

where  $n_1, n_2, n_3, n_4$  and  $n_5$  are the number of respondents who scored the responses as 1, 2, 3, 4 and 5 respectively.

## DATA ANALYSIS AND RESULTS

Data analysis was carried out using the mean ranking analysis of responses to the questionnaire survey. The first part of the analysis examines the awareness and perception of CDM regulations. The second part investigates the extent of implementation of specific CDM regulations whilst the third part assesses the factors inhibiting compliance with CDM regulations at the design stage.

### Awareness and Perception of CDM Regulations

The awareness and perception of CDM regulations by respondents were investigated by framing some constructs about CDM regulations and asking respondents to provide opinions about them. Specifically, they were asked to provide their opinion on a Likert scale of 1 to 5. The strength of opinion was measured with 1 indicating strongly disagree, 2, disagree, 3, no opinion, 4, agree and 5 indicating strongly agree. Table 2 shows the result of the analysis. From Table 2, it is evident that the designers, the planning supervisors, the project manager as well as building surveyors were all in agreement that they were fully conversant with their duties under the CDM regulations. They are also all in agreement that the CDM regulations are clear and concise. However, whilst overall, respondents agreed that 'the CDM regulations are clear and generally logical, but some areas require clarification', the building surveyors seem to disagree. This is a surprise as the generally held view is that some aspects of the regulations contain unspecific wordings, making them open to interpretations if there are no clarifications. However, since it is only the building

surveyors that disagreed, it is an indication that attention needs to be focused on the opinion of the respondents who are directly involved in carrying out CDM regulations.

On the other hand, all the respondents disagreed that ‘the CDM regulations are ambiguous and confusing.’ They also disagreed that ‘the CDM regulations are complicated and difficult to understand.’ The respondents further disagreed that whilst they were aware that they have duties under the CDM regulations, they were not familiar with the details. Moreover, the respondents strongly disagreed that they do not have any duties under the CDM regulations. This sharp divide between the ‘agreement’ and ‘disagreement’ with the constructs is a surprise because it seems to challenge the view of Dorrell (2003) who observed that ‘the number’ of practices that really understand CDM completely is very small. It also seems to challenge the findings of HSE (2003b) that only one-third of designers were considered to have ‘sufficient knowledge’ of the CDM regulations to allow them perform their duties effectively.

**Table 2:** Awareness and perception of CDM regulations

<b>Awareness and perception of CDM regulations</b>	Overall	Designer	Planning supervisor	Project manager	Building surveyor
I am fully conversant with my duties under the CDM regulations	4.31	3.76	4.75	4.57	4.17
The CDM regulations are clear and concise	3.70	3.52	3.88	3.71	3.67
The CDM regulations are clear and generally logical, but some areas require clarification	3.32	3.42	3.63	3.57	2.67
The CDM regulations are ambiguous and confusing	2.32	2.42	2.25	2.29	2.40
The CDM regulations are complicated and difficult to understand	2.25	2.30	2.00	2.29	2.33
I am aware that I have duties under the CDM regulations, but I am not familiar with the details	1.71	2.14	1.13	1.57	2.00
I was not aware that I had specific duties under the CDM regulations	1.31	1.52	1.13	1.43	1.17
I do not have any duties under the CDM regulations	1.22	1.33	1.13	1.43	1.00

### Implementation of Specific CDM Regulations

The extent of implementation of specific CDM regulations was also investigated. This was done by extracting the six main duties of designers under the CDM regulations as detailed in the Construction Information sheet No. 41 (HSE 2002b). These duties are listed under ‘CDM regulations’ in Table 3. Respondents were then requested to provide their opinion regarding the extent of implementation of these duties. The strength of the respondents’ opinion was measured on a Likert scale of 1 to 5, with a score of 1 indicating very low extent whilst a score of 5 indicates extremely high extent. Table 3 shows the result of the analysis. From Table 3, it is evident that ‘the avoidance of foreseeable risks to health and safety of any person carrying out construction work’ ranked highest overall and also by the planning supervisors,

project managers and building surveyors. It however ranked 3<sup>rd</sup> by designers' scoring. Complying with this regulation is probably one duty that designers are expected to be able to carry out most effectively. It involves assessing the risks of their design that can be foreseen and designing-out or minimising those risks. Effective execution of this particular duty requires the designer to have knowledge of construction methods and materials as well as risk management techniques. It is therefore a surprise that whilst it ranked 1<sup>st</sup> overall, and also by other professionals surveyed, it however ranked 3<sup>rd</sup> under the designers' scoring. This suggests that designers accord higher priority to complying with other areas of the regulation than that dealing with carrying out construction works. This seems to underscore the need to incorporate studies in construction methods and risk management into the training curriculum of designers.

Moreover, it is evident from Table 3 that 'avoidance of foreseeable risks to health and safety of any person carrying out maintenance or cleaning work during the life of a building' ranked 1<sup>st</sup> under designers' scoring, whilst it ranked 2<sup>nd</sup> under the planning supervisors and project managers' scoring. It however ranked 5<sup>th</sup> under the building surveyors' scoring. These differences of opinion suggest that respondents perceive the extent of implementation of this CDM regulation differently. This lack of consensus of opinion seems to underscore the finding of HSE (2003b) that with regard to the risk of fall from height during maintenance or cleaning, many designers saw the safety harness as the 'cure-all' without giving any consideration to the elimination of risk of working at height which would have enabled them to successfully meet this requirement of the regulations. It is however noteworthy that as building surveyors are involved in carrying out building maintenance, their low scoring of designers' implementation of this regulation suggests that designers need to do more in implementing this regulation.

Furthermore, it is evident from Table 3 that overall; respondents scored high, CDM regulations dealing with 'combat of risks at source' and 'avoidance of foreseeable risks to health and safety of any person during future demolition of the building.' Combat of risks at source requires designers to overcome any risks in their designs prior to the commencement of work on site, rather than leaving it to the contractor (Croner 1998). Avoidance of risks to health and safety during future demolition is indeed a difficult task as the regulation places a demand on the designer to know how the building might be demolished and how the construction materials will react after demolition. It is however noteworthy that whilst the designers and other professionals scored the implementation of these two CDM regulations high, the planning

**Table 3:** Extent of implementation of specific CDM regulations

CDM regulations	Overall		Designers		Planning supervisor		Project manager		Building surveyor	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Avoidance of foreseeable risks to health and safety of any person carrying out construction work	3.43	1	3.43	3	3.5	1	3.29	1	3.5	1
Avoidance of foreseeable risks to health and safety of any person carrying out maintenance or cleaning work during life of building	3.15	2	3.67	1	3.13	2	3.14	2	2.67	5
Combat of risks at source	3.07	3	3.62	2	2.63	4	3.00	4	3.00	3

Avoidance of foreseeable risks to health and safety of any person during future demolition of the building	3.06	4	3.19	6	2.88	3	3	3	3.17	2
Cooperation of designers and planning supervisors to improve health and safety	2.89	5	3.29	4	2.57	5	2.86	5	2.83	4
Passing of information to planning supervisor	2.82	6	3.24	5	2.5	6	2.86	5	2.67	5

**Table 4:** Factors inhibiting risk reduction at the design stage

Inhibiting Factor	Overall	Rank	Design	Rank	Plannin g supervis or	Rank	Project manager	Rank	Buildi ng survey	Rank
Inadequate time to explore design alternatives	3.02	1	2.73	1	3.13	2	3	1	3.2	2
Budget constraint imposed by client	3.01	2	2.38	2	3.25	1	3	2	3.4	1
Insufficient information about the sequence or number of people involved	2.52	3	2.06	3	2.71	4	2.5	3	2	4
Lack of information regarding construction methods	2.12	4	1.76	4	2.71	3	2	4	2.8	3

supervisors scored them low on average. This seems to sound a note of caution as the planning supervisors have the duty to ensure that designers are carrying out their responsibilities correctly. As such, the strength of their opinion suggests that designers need to do more in implementing these regulations.

It is also evident from Table 3 that overall, respondents scored low, CDM regulations regarding ‘cooperation of designers and planning supervisors to improve health and safety’ and also ‘passing of information to planning supervisor.’ Whilst designers scored their extent of implementing these regulations high on average, other respondents scored them low on average. This suggests that designers might have inflated opinion of their extent of implementing these regulations. It is therefore instructive that designers may need to do more in fostering cooperation between themselves and planning supervisors to improve health and safety. They also need to improve on passing information to planning supervisors.

**Factors Inhibiting Designers from Complying with CDM Regulations**

In order to unearth the root cause of non-compliance with CDM regulations in the designers’ design, factors perceived to inhibit compliance were identified from literature and from discussion with professionals. Respondents were requested to provide opinion by scoring these factors on a Likert scale of 1 to 5. The scale is as defined in the last section. Table 4 shows the result of the analysis. From the table, it is evident that ‘inadequate time to explore design alternatives’ and ‘budget constraint imposed by client’ are two factors that were scored high overall as inhibiting compliance with CDM regulations. Whilst these two factors were scored high overall, it is noteworthy that designers scored them low on average. This suggests that whilst designers do not perceive these factors as having high impacts in inhibiting their ability to comply with CDM regulations, other respondents perceived it as such. This

is revealing and an indication that designers need to consider the opinion of other professionals to help them get to the root cause of non-compliance and make amends accordingly.

The other two factors investigated; namely, 'insufficient information about the sequence or number of people involved' and 'lack of information regarding construction methods' were both scored low overall and by individual professionals that responded. This is an indication that these two factors do not contribute significantly to inhibiting compliance with CDM regulations at the design stage.

## **CONCLUSION**

This study has attempted to examine the awareness and perception of CDM regulations by designers and other construction professionals. It also investigates the extent of implementation of CDM regulations by designers as perceived by designers themselves and other construction industry professionals. Finally, it examines the factors inhibiting designers from complying with CDM regulations at the design stage.

The study concludes that designers believe that they are fully conversant with their duties under the CDM regulations and that the CDM regulations are clear and concise. This was also corroborated by other professionals in the survey. It is however expected that if this assertion is true as the result showed, then the number of accidents on construction sites should be decreasing. However, the HSE (2003a) has revealed that this is not the case. A further conclusion that seems to throw light on this is that the majority of respondents agreed that the 'CDM regulations are clear and generally logical, but some areas require clarification.' This conclusion seems to suggest that the nature of the regulations is preventing designers from fully understanding their responsibilities and thus hindering their ability to minimise risks during the design stage of a project. This seems to agree with Caldwell (1999) who states that the CDM regulations have had a 'substantially beneficial effect on construction health and safety management' but that there is a need for 'authoritative guidance on the practical implementation' of the duties it enforces.

The study further concludes that overall, respondents' perception of extent of implementation of specific CDM regulations seems to follow an order, dealing firstly with carrying out construction works, followed by maintenance or cleaning work and future demolition of the building. This order seems to follow a logical building life cycle of construction, maintenance and demolition. This appears to indicate that the nearness of each of these operations to the designer seems to influence the extent to which they were able to implement the specific DCM regulation relating to them. It is however a surprise that the ranking of designers' scores placed maintenance ahead of construction. This seems to underscore the finding of HSE (2003b) that with regard to the risk of fall from height during maintenance, many designers saw the safety harness as the 'cure-all' without giving any consideration to the elimination of risk of working at height. In view of the seemingly inappropriate priority accorded avoidance of foreseeable risks in relation to construction works, it is suggested that designers' training curriculum may benefit from studies in construction methods and risk management.

The study finally concludes that designers' inability to comply with CDM regulations at the design stage seems to lie in inadequate time to explore design alternatives and budget constraints imposed by the client. It is however a surprise that whilst other respondents were able to finger these, designers failed to come to terms with these



factors. It is therefore suggested that designers need to consider these factors in their attempt to comply with CDM regulations at the design stage.

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