AN INVESTIGATION INTO SAFETY ATTITUDES AND SAFETY PERFORMANCE IN THE CONSTRUCTION INDUSTRY

by

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EDWIN O. O. SAWACHA

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DECLARATION

The contents of this Thesis represent the findings of a programme of advanced research which was developed as a result of the writer's previous exploratory study:

> Sawacha, E O O: *Employer and Employee Attitudes towards Safety Representatives and Committees in the Construction Industry*

submitted to Brunel University, Department of Building Technology, MSc Thesis, 1982.

Appropriate references to this work are indicated in the text of the Thesis.

DEDICATION

To my dear late parents:

Madam Eyoroware Lebugha Sawacha (Mother) - died 14th September, 1992 at Ibadan UCH, Nigeria.

Chief James Ogodokpan Sawacha (Father) - died 12th December, 1952 at Egodor, Nigeria;

and

For my wife Barbara Colleen, my children Zimi, Ebitare, Tamaraye, and Kemedi-Bimor Sawacha, and to all those who contributed to the enrichment of my life.

ABSTRACT

This research investigated various factors considered to influence safety attitudes of construction workers, and management, towards safety performance in the UK Construction Industry.

The factors examined are listed in the research model and consist of historical, economic, psychological, technical, procedural, organisational, environmental, and safety performance variables (factors).

The study based upon the above factors was conducted under the key assumption that:

"Safety Performance is a function of operatives' and management attitudes in respect of behavioural and environmental factors in the Construction Industry".

This key assumption lead to further sub-hypotheses, namely:

a) Safety performance is a function of operative attitudes towards the above listed factors;
b) Safety performance is a function of management attitudes towards the above listed factors;
c) Operative attitudes towards the above factors differ from those of site managers;
d) Site managers' attitudes towards the above factors differ from those of contract managers, and safety advisors, etc.;

The research methodology centred upon literature reviews, interviews and questionnaires administered to operatives, site managers, contract managers and safety advisors, in ten construction companies in the UK, covering a sample population of 325 subjects.

Analysis of the 325 questionnaires suggests that the key research assumptions, and attendant sub-hypothesis are found to be valid as far as the research data examined are concerned.

Ultimately, the results of multivariate analysis determined that organisational factor, and industry norms, are the primary and most dominant influence upon safety performance in the UK Construction Industry.

CHAPTER ONE

Introduction to the Research

CHAPTER ONE

1.1 INTRODUCTION TO THE RESEARCH

Health and Safety at Work is in itself a complex phenomenon, and the subject of 'Safety attitudes and safety performance' in the construction industry is even more so. Where man and work interact, particularly in such a complex and uncertain environment as construction, there are bound to be problems of human behaviour, weather effects, geology and unforseen circumstances resulting in accidents.

The disruptive effects of accidents in the construction industry are clearly classified and well-documented almost annually in the United Kingdom (Health and Safety Executive Reports: 1952-88). The impact of accidents, and health and safety in general include the following:

a) Loss of employee morale.
b) Financial implications for the individual, the company and the State.
c) Psychological consequences for the individual, colleagues, and the family.
d) Pain, suffering or death, resulting in incalculable consequences to the individual, family, company, the State and society at large, etc.

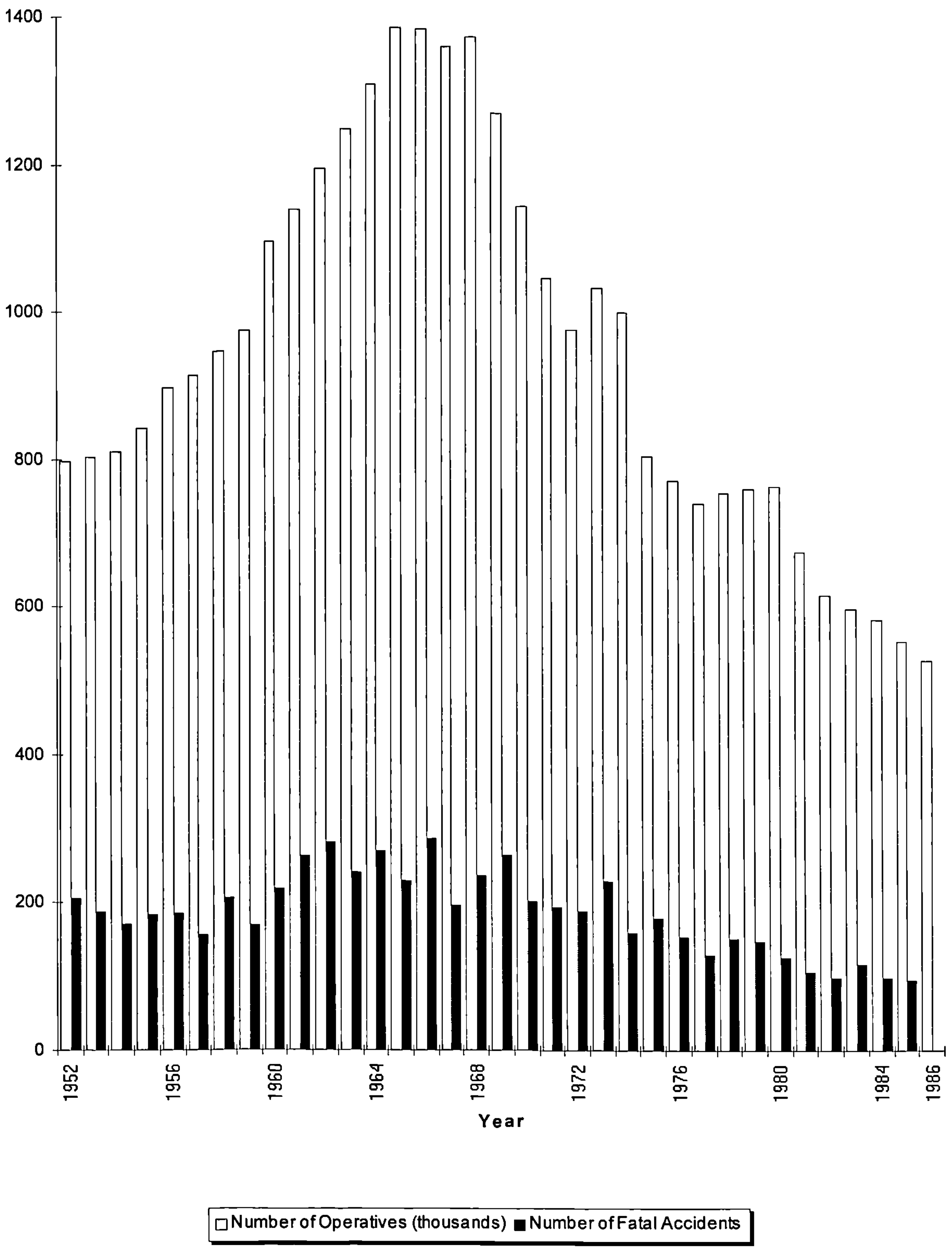
The office of Health Economics (1978-85) has recently indicated that there were over 370 million lost working days due to classified incapacity in United Kingdom.

The Health and Safety Executive (1984/85) reported that over 15 million days were lost due to industrial injuries.

This volume of industrial statistics is quite substantial, and of considerable concern to managers of industry, the medical profession and society in general. It remains however, one of the paradoxes of post-industrial revolution that in spite of a systematic rise in real earnings, improved working conditions and environments, and major advancement in technological developments in industry at large, there remains a steady increase in the level of industrial injuries or accidents, particularly in the construction industry (ref: Figure 1.1, p3 below).

The amount of working time lost through industrial injuries, and other causes, and the means by which such factors might be reduced, has been a matter of general concern to the workers, managers, and safety practitioners through centuries, as industry transforms from craft-orientated work to the use of sophisticated technology. In very recent years (at least the past twenty years) individual companies, trade union organisations, and government agencies concerned with Health and Safety in the workplace, have intensified the amount of effort given to the problem, and this has led to the evolution of a uniform method of classification of accidents, and safety performance measurement criteria, together with an improvement in the general understanding of the accident

FIGURE 1.1 ACCIDENT TRENDS IN THE UK CONSTRUCTION INDUSTRY



and safety phenomenon.

Despite these changes in the health and safety climate, there appears to be no marked initiatives on the part of the researchers or safety practitioners towards the facilitation of meaningful comparative studies into the psychological aspects of safety in the UK construction industry. Accident rates in the construction industry, along with construction turnover figures, and productivity or performance indicator factors, are more often considered as objective measures of relative efficiency of a construction company.

Organisations with high employee incident rates, in terms of occupational injuries, are generally considered as less efficiently managed organisations than those having a lower accident rate (ILO, Geneva, 1984).

It is also generally assumed that:

> 'attitudinal and behavioral factors of employees can be related to this objective measure of efficiency. Workers who are not particularly keen or interested in their jobs, or who are dissatisfied with their work situation, might be more inclined to perceive accident as a means of withdrawal from the work situation, than those who enjoy their work, and were satisfied with the aspects of supervision, and with the opportunities their jobs provide for pay, self-esteem, promotion, and establishment of relationships with their peers.
>
> (Hale and Hale, 1970)

Most studies have found that many of the accident occurrences on construction sites can be avoided. They stated that quite often, "these accidents are exacerbated by human factors, climatic factors, and the physical, as well as the technical aspects of the more rigorous occupations" (Atherly, 1978; Shimmin, 1980).

The result of accidents on site, is clearly undesirable since it presents a major threat to site work, and the individual domestic welfare, whilst imbalance of production, plant/machine usage time for profitable production, material turnover, low worker morale, and low productivity rates, are just some of the more pronounced or tangible consequences of industrial accidents. Whilst the level of construction accidents remains high in the UK construction industry, its level varies amongst contractors and from site to site; for it is the result of certain important factors which act upon the individual and/or groups, both in the job environment, and outside the work situation. These principal factors associated with safety behaviour, broadly concern the following:

a) daily and seasonal variations of the site;
b) occupational category;
c) medical and health factors, and

d) personal and organisational variables.

The model for this study shown in Chapter Three (Fig 3.8), demonstrates the role of these factors which represent a web of complex relationships that ultimately shape safety behaviour. The model is evolved around certain theories of risk/safety behaviour.

Various studies have shown that a substantial part of safety or risk behaviour is essentially non-medical, the safety decision is therefore predominantly personal. (Suchmann, 1961), (Surry, 1969), (Hale and Hale, 1970), (Wrigglesworth, 1972), (Hale and Perusse, 1978), (Andersson et al, 1978), (Perusse, 1980).

Abeytunga (1979) on the other hand, demonstrated that organisational factors, particularly the identification of safety training needs and training of employees in hazard identification is an organisational decision, and should not be left to the individual employee.

There are however, bound to be other factors in between as shown in the chosen research model (Fig 3.8). The main objective in safety behaviour (safety attitudes and safety performance) measurement and analysis, is therefore to distinguish between the human factor causes, and the organisational factors. For an accident may be determined either solely by Human factors, or by the interaction between humans, the work situation, and the organisational factors.

Thus, the separation of human and organisational factors etc, constitutes the fundamental stage of some form of safety/accident control process, though subsequent control strategies ought to be [ideally] linked to certain concepts in the field of attitudinal and motivational [psychological] theory. This conviction, together with the writer's previous work and experience (Sawacha and Langford, 1987), constitute the drive behind this study.

Whilst the research may aim to compensate to some extent, the deficiency of work concerning 'safety attitudes and safety performance', in the field of construction, the main thesis advanced in support of the study, was that of producing suitable criteria upon which decisions might be based concerning certain management practices, and policies, associated with Health and Safety of employees, and the possible prevention of accidents, and control on site.

Furthermore, the effectiveness of safer construction management in the construction industry is dependent upon a detailed knowledge, and understanding of:

(a) Hazard identification techniques;
(b) Positive safety attitudes by operatives, and management; and
(c) Improved safety performance.

The above factors must all be jointly focused upon and developed to meet the desired goals of a safety-orientated construction environment. Ultimately, the attainment of such goals must depend largely upon educational institutions at all levels, the construction industry itself, government legislation and enforcement, a more effective policing of the workplace in the industry by management, and the Safety Inspectorate, and more essentially, industry-focused safety research on the behavioral, mechanical and environmental aspects of Health and Safety in Construction.

With these broad aims/objectives in mind, this study is developed to explore the various aspects of worker/management attitudes and safety performance in the (UK) construction industry.

1.2 DEFINING AND DISCUSSING SAFETY ATTITUDES

The term "attitude" is derived from the subjects of social sciences, particularly in the field of social psychology or psychology in general. Within this specialised field of the study of human behaviour, has emerged diversified definitions of the term "attitude", and most social scientists would agree that no single definition of the term can be suggested as being definitive. Each definition places its emphasis upon a single or multiple factor, and to some, the words "attitudes" and "opinions" are almost synonymous; however, those working in the field of attitude studies proffer a number of definitions for the term "attitude".

General opinion suggests that everyone has an attitude, and hence people would use the word "attitude" to describe any form of human behaviour. For example, assertions like 'people's attitudes today are the same ...' 'everyone for himself ...'; 'young people's attitudes today are all about drugs, sex, 'disco-mania', and football hooliganism'. In the construction industry, statements of attitudes/opinions are commonplace. For example, "safety is a matter of commonsense"; "safety is a matter of individual attitudes - if the attitude is right, accidents will not happen"; "the cowboys of the trade have bad safety attitudes, and they give the industry a bad image".

The above statements may be expressive of attitudes, nevertheless, they fall short of a scientific definition of "attitudes". Some discussion may identify the meaning of the word "attitude".

"Attitudes" simply stated, are defined as "a tendency to react positively or negatively towards an object or a person" (Sartain et al. 1974).

Porter et al (1974) on the other hand, describes attitudes as "either explicitly or implicitly related to people, events, actions, ideas or institutions". In other words an attitude has an 'object' (the term 'object' here is used to denote any aspect of the world, including people and ideas, towards which we have an attitude).

Some further characteristic is that "attitudes express the way a person evaluates the degree of positive or negative feelings he/she has towards the object in question, for example: "attitudes towards aspects of work, people, or even safety procedures in the construction industry".

Krech and Crutchfield (1948) stated that "attitudes are relatively enduring, and that, if you know a person's attitudes, you can usually predict what he/she will say or think in future reactions to that object or similar objects". Attitudes therefore, must be based on some underlying physiological/experimental system 'inside people'.

Gordon Allport in giving "attitude" a physiological slant, described "attitude" as a "mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which he/she is related (Allport 1954). Similarly, Krech and Crutchfield (1948) defined "attitude" as

> "an enduring organisation of motivational, emotional, perceptional and cognitive process with respect to some aspects of the individual world."

From the above illustrative definitions, it becomes apparent that "attitudes" generally, and "safety attitudes" especially are specifically not tangible; they are only inferred.

The concept of "attitudes", or "safety attitudes", therefore is indeed nothing but an abstraction. It is used to denote certain consistencies in a person's behaviour, statements/opinions, and presumably, experiences and beliefs. According to English and English (1958), "attitude is a hypothetical construct". Other sources define an attitude as

> "an inferral entity conceived as actually existing and as giving rise to a measurable phenomenon, including phenomena other than the observables that led to hypothesising the construct".

The implication of the fact that it is 'a hypothetical construct' is that there is no one absolute and final definition of the concept of "attitude" or "safety attitude", any more than there is of the abstract terms, 'opinion', 'truth', 'beauty' or 'justice'. The definitions given will depend on what observables are selected as a basis for inference. As such, the concept of "safety attitudes" must be viewed as complex and multi-dimensional. Like Krech and Crutchfield (quoted above) and Katz (1960) "safety attitude" is seen by the author as having an emotional or affective aspect, that is, it embodies positive or negative feelings about the object of 'safety behaviour' in construction; a cognitive aspect - beliefs or ideas/opinions about it; and conative aspect - a tendency to behave in a particular way towards aspects of construction. Katz (1960) has described "attitude" as "the predisposition of the individual to evaluate some symbol or object, or aspect of his/her world in a favourable or unfavourable manner".

> "... attitudes include the affective, or feeling core of liking or disliking, and the cognitive or belief elements which describe the effect of the attitude, its

characteristics, and its relations to other objects (p168).

The problem therefore in defining what is "safety attitude" and what behaviour shall be studied for a particular piece of research illustrates one point: namely that there is no such specific thing as a "safety attitude". Therefore the choice of definition and of behaviour to be studied can only be decided by the use to which the research findings are to be put.

If the main reason for the study is to positively influence causes of fatal and lost-time accidents reported from construction sites to the Health and Safety Inspectorate, then such must be the subject for study even though some of the factors affecting whether or not an injury is reported as a lost-time accident have no bearing on the causation of the original injury. If the aim of the study is to reduce the incidence of that dangerous behaviour which has been defined as dangerous, then the incidence of dangerous behaviour must be the object of attention or inference.

Brown and Smith (O.U. 1974) have asserted

> "... that attitudes and beliefs are not mere reflections of aspects of the world with which an individual comes in contact but rather constructions, coloured and shaped by efforts to maintain consistency, not just with related beliefs, but with personal needs and actions, external demands and social context".

This study has set out to study "safety attitudes" and "safety performance" in terms of variables selected as factors of influence on the subject matter, and are shown in the research model within the thesis (Fig 3.7).

1.3 DEFINING AND DISCUSSING SAFETY PERFORMANCE

The term "safety performance" has been applied for many years in connection with the safety/accident phenomenon, in terms of accident reporting as well as with safety audit in most industries, including the construction industry. Whilst the problem of safety performance measurement has existed since the very beginning of organised attempts to control accidents and accident consequences, the main difficulty has been 'what was meant by measurement'. In its most rudimentary form, "measurement" has been defined as "the process of assigning numerals to objects according to rules" (Stephen 1951).

In an industrial context, what "object" to measure and what "rules" to follow, is dependent upon what form of performance is considered. Some of the commonest performance measurements in industry surround productivity measurement, quality assurance, financial, as well as safety performance. In the main, safety performance measures seem to be centred around one essential element - "accident statistics"; aimed at accident control (after the event), and prediction (for the future). Tarrants W.E. (1970) suggested that in accident control and prediction valid and reliable measurements of safety performance are essential in order to satisfy certain objectives. Such objectives, he stated were to include the following:

"to (1) locate and describe problem areas;
(2) identify casual relationships;
(3) make decisions concerning the optimum allocation of accident prevention resources;
(4) evaluate the effectiveness of applied counter-measures; and
(5) detect when the system is deteriorating toward unacceptable limits of control".

Tarrant (1980) has since argued that

> "unfortunately, none of the traditional measures of safety performance permit achievement of the above objectives effectively".

He asserts that on more pragmatic grounds, the measures of safety performance are inadequate because members of top and middle management often simply do not believe them, as evidenced by the frequent complaint of safety directors (in the USA), which is "if only I could convince my managers to accept and act on my recommendations".

Recently in the UK, the Accident Prevention Advisory Unit (APAU) of the Health and Safety Executive (HSE), has pointed out that: "Accident statistics are only one index of safety performance and even then, are only an index of failure" (APAU), 1985).

Morgan and Davies (1981), found that:

> "... for every major injury accident, there are ten property damage accidents, and for every property damage accident, twenty near-misses".

They reported that the objective for conducting safety audit/performance is "to reduce the number of hazards and thereby reduce the number of accidents". Their report went on to state that: Safety performance audits -

(1) "should seek to be positive rather than being preoccupied with fault-finding;
(2) should be capable of identifying deviations from agreed standards;
(3) should be analysing events which lead to them, and
(4) should highlight good practices".

Morgan *et al* concluded that:

> "the majority of safety performance audit schemes tend to concentrate on the 'hardware' aspects of accident prevention, such as machinery-guarding, the provision and use of protective clothing and equipment, and exhaust-ventilation systems, and are primary hazard-spotting exercises. It is equally important for audits to emphasize 'software' aspects, such as safety systems of work, safety instruction, training and supervision".

In brief, safety performance entails the collation of accident information covering the following events:

a) injury to persons requiring 'First Aid' attention, minor injury leading to absence from the work situation, serious injury requiring hospitalisation, and fatal injuries/death etc;
b) non-injury accidents to persons causing minor or no disruption to the person or work situation;
c) property damage etc, and
d) near-misses etc, causing one effect or the other to persons, property, and the work environment.

This is the context in which this study views safety performance throughout.

1.4 THE NEED FOR THE STUDY

For many years, writers worldwide, particularly in the developed and industrialised societies, have grappled with the problem of understanding the 'accident' or 'safety' phenomenon (Warr, 1978) (Hale & Hale, 1970). Several researches and papers have been produced in such areas as: accident-proneness; the classification of accidents; the influence of age, race, intelligence etc; ergonomic factors; safety propaganda; stress; safety motivation and many other areas of diverse interests, with the subject area. Many attempts are being made worldwide too, to find ways and means of preventing and reducing accident occurrence.

Although all these endeavours have failed to produce a solution of a zero accident-rate (a Utopian ideal), nevertheless, major in-roads have been made into the understanding of human behaviour in terms of interaction between man and his work environment. Such contributions are based on the formulation and accumulation of knowledge. In many ways however, researchers in the UK have ignored the need to identify the relationship between safety attitudes and safety performance in the construction industry (Shimmin, 1980).

This research is an attempt to fill that gap. The need for the research is hence, to contribute some knowledge and understanding of the subject area of safety behaviour.

Finally, the study is potentially useful for further research, to explore and co-ordinate existing knowledge, and to expand upon such knowledge through the analysis of the collected data for this research. Also, future policy-makers and safety practitioners may benefit from the outcome of this research by promoting better safety measures and coherent safety management procedures within the construction industry.

1.5 THE IMPORTANCE OF SAFETY RESEARCH, AND THE IMPACT OF ACCIDENTS

The importance of safety research and the impact of accidents cannot be ignored. The essence of safety research is mainly geared towards the finding of possible solutions to accident prevention or reduction, and the building up of a knowledge base within the industrial environment and society at large that will contribute towards the creation of safety awareness.

Such is the case that, it is very doubtful if any single solution will cover all types of safety events applicable to the subject of industrial safety and accidents. Nevertheless, the impact of accident occurrence on society as a whole is incalculable. The Royal Society for the Prevention of Accidents reports that in 1982, more than fifteen and a half thousand people were killed, and well over half a million people received serious injuries as a result of accidents in Great Britain. More recent figures (April 1988) by the Health and Safety Executive, indicating accident occurrence across all industries, have shown that 175,000 injuries at work were serious enough for the victims to need more than three days off work, and 405 cases were fatal. The cost of such occurrences to the British economy, individual concerns/enterprises and the psychological trauma which families of the deceased or seriously injured suffer, is considerable.

1.6 THE CONTENT OF THE THESIS

The Structure

The first three chapters of the thesis cover the general introduction to the research, and outline the methodological approaches adopted for the research; establish its literature base by way of reviewing current knowledge concerning the subject matter of the research, and discuss the theoretical framework, including explanations of previously designed research models as applied by others, and which the writer considered to be relevant to the current research. Finally, they discuss the research model as designed by the writer for the specific purpose of this study. These chapters are hence structured as follows:

CHAPTER ONE:	Introduction
CHAPTER TWO:	*Literature*
CHAPTER THREE:	Theory - explaining other relevant research models, the "research model" for the study, and chosen hypothesis and sub-hypotheses tested for this research.
CHAPTERS FOUR & FIVE:	Look at the analytical background and details of data collected, and review the research findings that tie up with the literature reviewed in Chapter Two: that is, Chapter Four -Analytical Content; Chapter Five - Review of Findings that tie up with the literature as discussed in Chapter Two.
CHAPTER SIX:	Discuss the overall results of the research, and the conclusions drawn from the results of the research analysis as contained in Chapters Four, Five and Six collectively.

This chapter also contains the following:

(i) Recommendations for further research;
(ii) Implications of the research;
(iii) List of references, and finally
(iv) Appendices.

1.7 SUMMARY

This introductory chapter to the research has attempted to outline some of the more important methodological and conceptual issues concerning the assessment and implications of safety attitudes and safety performance in the construction industry.

The meaning, classification, measurement format, and levels of analysis of safety attitudes and performance are shown to reveal the difficulties which confront researchers of the subject matter of safety and accident studies, and the various factors which lead to the use of distorted data, and hence misleading or haphazard conclusions.

Some of these factors were thus given due consideration in the formation of the objectives of this research, and the subsequent research design.

Whilst an attempt has been made to portray a snapshot of the contents of individual chapters at this stage of the research, reliance should be placed on the material covered within the boundaries and depth of each chapter, in order to appreciate the fullness and scope of individual chapters throughout the thesis.

CHAPTER TWO

Literature Review

CHAPTER TWO

2. LITERATURE REVIEW

2.1 INTRODUCTION

The Literature Review is based upon materials searched, and researched throughout the duration of the study between September 1984 and December 1989. Material reviewed contains both 'published and unpublished' work, and is consistent with general research ethics, codes, and methodologies. For the purpose of this study, 'published' work is defined as: all papers or articles of academic, professional or general nature, published for a wider readership. On the other hand 'unpublished' work/material, means all research projects, studies and theses, produced by various institutions, including educational (ie. Universities, Polytechnics, Colleges etc.), professional bodies or organisations, which are published mainly on the basis of a systematic/scientific research, and stored within the confines of academic libraries, or organisational archives, and used as a reference source. Such materials can only be accessed with permission from the bodies that own them. They are not aimed at a general readership, but for specialist groups.

Literature search and review has three principal aims:

(i) To introduce a broad or general background to the subject matter as covered by the researcher, in terms of reading and consultation.

(ii) To assist the researcher in the acquisition of general and specific knowledge that is relevant to the subject matter being investigated or researched.

(iii) To assist the researcher in formulating and developing a broadly-based research framework, and model, upon which a sound research methodology can be based.

In the main, a literature review provides the researcher with the basis for a clear understanding of the subject of his/her research, using existing or available knowledge produced by others before him/her.

2.2 GENERAL BACKGROUND AND DEFINITION OF RISK

Since the dawn of civilisation, the human race has had to consider and contend with, the various threats surrounding it from its environment. Such threats have occurred, and continue to occur, either through natural disasters such as earthquakes, floods, storms etc, described as "Acts of God" by some or as a direct result of human interaction with the environment. Such environments may include the home, the workplace or other facets of human activity. Uncertainty over these threats was, and remains, the essence of human behaviour. The future of mankind, and the prediction of it has therefore always occupied the human imagination since historical times to modern day. Consequentially, survival has played a dominant or crucial role in influencing human attitudes, and behaviour towards risks.

"Risk" has been described in a article entitled 'Do we need risk managers in construction?' as "The essential fuel on which all commercial enterprises run"; so it may seem strange to describe it as a problem "yet uncontrolled risk can threaten and destroy the profitability of any company" (Tye, James 1980)1. Tye, 1980 commented that:

> "any businessman who realises the importance of quality controls, training schemes, fire procedures, or insurance policies is aware of the need to control risk, but until recently few people have attempted to co-ordinate these procedures into a specialised managerial role".

The concept of risk therefore associated with uncertainty, fear and worry, has become an essential part of human nature. The earliest civilizations organised compensation for those suffering loss due to mishaps or accidents (Hamm Urabi's Code). In more general terms, society has perceived threats and risks, and accordingly created systematic procedures to deal with them. On the other hand, these societies suffered vast degrees of losses because of great disasters. Perhaps typical examples of disasters of this kind are: the Fire of Babylon, 538BC; the Fire of Rome 64AD; the Fire of London, 1666; earthquakes and the Fire of San Francisco, April 1906 (Jones, 1978).

The pattern of catastrophe has not changed since. Each year, disasters take place, in the UK, or somewhere in the Universe. Most of these disasters are caused either by natural phenomenon (ie. "Acts of God"), through technological/scientific advancement, eg. Radioactive waste.

Lagadic (1982), in his book, highlights an analysis of major technological disasters/risks. He presents a general profile of the major industrial risks which predominate this century.

New catastrophes, he asserts, are often a result of technological advances and industrial progress. Most of the notable technologies utilised in petrochemical industries, pharmaceutical, mining, construction, aeronautical, and nuclear plants are exceedingly hazardous sources of risks. Klets (1985) demonstrates that certain incidents are near-misses, and management ought to learn from them. He explains in a detailed and analytical manner, all technical causes of major incidents, where human error has been shown to be a source of many accidents. Thus, the growth of technology has created disastrous situations that have led to disastrous consequences. The same new technologies have created new trends of attitudes, and perceptions of human behaviour and risks. Perhaps, disasters of this type and scale are epitomised by: Flixborough, June 1974, United Kingdom; Seveso, July 1976, Italy; Three-Mile Island, March 1979, USA. The latter was considered more of a near-miss.

The Flixborough disaster highlighted several issues that had previously been ignored or neglected. These issues included risk planning, lack of training, negligence of safety measures and procedures, and even more important, the lack of coherent risk management systems and codes. According to the 'Report of Inquiry' (1974) the Department of Employment, the Flixborough disaster occurred mainly because of the "lack of safety training on the part of the operatives". The Report went on to state that "there was the general attitude of complacency, and a tendency to overlook unlikely risks". It concluded: "... nobody ... foresaw the possibility of a major accident".

More recently, there have been other major disasters, for example - Bhopal (India) where over 1,000 people were killed, and some 20,000 injured. "Another man-made disaster of all time". (Mackenzie, 1984); (Morris, 1984).

In Belgium (1988) the Zeebrugge disaster occurred, the result - the Townsend Thoresen Ferry, called Herald of Free Enterprise, capsized, killing lots of passengers, and also causing many injuries to people. The formal investigation found that: " ... the company and the Ship's Master could be considered negligent ... the direct result of commercial interests". (Guardian, June 15, 1988)

The Seveso tragedy (Italy 1976) brought the introduction by the EEC (European Economic Community), of The Control of Industrial Major Accident Hazard Regulations (CIMAH). This compels industries which have "processes and storage substances" to draw up on-site emergency plans, to inform the public adequately, and to bear the financial obligation towards such planning. In the United Kingdom, the Health and Safety Executive went further by introducing in October 1989, the COSHH (Control of Substances Hazardous to Health) Regulation. This compels organisations to catalogue all substances utilised by them, and to show their effects, protective measures, and safety precautions to be taken in the event of accidents etc.

During the last four years, many disasters have occurred and most of them were blamed on human error, negligence, complacency, or technological errors. Such disasters include: Bradford Football Stadium fire; Manchester Airport aircraft fire; King's Cross fire in London; Piper Alpha oil platform explosion in the North Sea; Clapham Junction Railway collision; Kegworth air crash; Purley rail crash; Hillsborough and the sinking of the Thames cruiser "The Marchioness". James Tye, Director General of the British Safety Council remarked: "I believe there is a common theme of disasters - they could have been prevented". (Guardian, August 23, 1989). Again, lack of training in safety systems and commercial interests were blamed.

> "Lack of spending on safety up-date, as well as reduced manpower to oversee safety of the public, and above all - complacency".

were to blame.

The Health and Safety Executive Report, made the following statement as a result of these disasters:

> "A high proportion of major disasters in the last two or three years has occurred in industries outside the remit of HSE - the Herald of Free Enterprise, Piper Alpha, King's Cross and Clapham. Is it right that the Department of Transport is responsible for both running and safety inspection of our railways, or that the Department of Energy checks its own safety record in the North Sea?"

It concluded:

> "Pursuit of profit must affect observation of safety standards and therefore, the Health and Safety Inspectors must be given the responsibility for these industrial sectors. Public safety must be guarded by a body that is both independent and fully resourced".
>
> (HSE Safety Report, 1988/89)

Further illustrations of disasters are shown in Table 2-1 (List and Frequency of International Natural Catastrophes and Major Losses, 1970-1981) and Fig 2.1 and 2.2 respectively below (World-Wide).

TABLE 2.1 Frequency of Natural Catastrophies and Major Losses - 1970-1981 (Global)

		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	TOTAL
1	**Natural catastrophes**	36	46	36	27	36	42	45	38	42	47	42	52	489
-	Flooding (incl. landslide, tidal wave, lava, rock, mud, avalanche)	18	21	17	12	19	19	18	17	15	18	16	23	213
-	Windstorms (syslone, hurricane, tornado, typhoon hail, snow)	12	18	15	12	13	20	17	13	22	20	19	22	203
-	Earthquakes	6	7	4	3	4	3	10	8	5	9	7	7	73
2	**Major fires**	16	23	24	26	23	21	26	37	26	26	34	22	304
-	Industr. (factories, warehouses)	9	12	11	13	14	14	15	22	12	14	15	12	163
-	Buildings (public and private)	3	5	6	6	6	4	5	7	7	4	11	4	68
-	Miscellaneous (mainly explosions)	2	3	2	3	1	1	1	2	2	2	2	2	23
-	Hotels	1	1	1	2	1	-	1	3	1	2	5	1	19
-	Oil storage, refineries	1	1	1	-	1	1	2	3	2	-	1	3	16
-	Department stores	-	1	3	2	-	1	2	-	2	4	-	-	15
3	**Aviation**	25	25	39	29	31	24	28	16	16	22	20	19	294
-	Crash (flight, landing, takeoff)	22	21	35	24	26	20	26	15	13	20	18	17	257
-	Explosion, fire	1	2	3	1	3	3	1	-	2	1	1	1	19
-	Damage on ground	2	-	-	3	2	1	-	-	-	-	1	-	9
-	Collision in the air	-	2	1	1	-	-	1	1	1	1	-	1	9
4	**Waterborne traffic**	15	22	17	20	24	20	18	18	23	16	16	24	243
-	Freighters (goods, ore, bulk, container)	8	11	5	7	12	8	5	5	8	3	4	8	84
-	Passenger ships (ferry, boat)	4	7	5	8	6	7	6	5	3	4	10	9	74
-	Tankers	3	3	2	1	2	3	5	4	8	6	7	2	46
-	Collision of ships	-	1	5	4	4	2	1	3	3	1	1	3	28
-	Offshore oil rigs	-	-	-	-	-	-	1	1	1	2	4	2	11
5	**Road and rail traffic**	18	36	28	21	14	20	19	18	15	26	14	25	254
-	Buses, coaches, lorries	8	21	17	12	11	11	12	6	8	14	10	11	141
-	Railway	9	13	11	7	3	8	4	9	4	9	3	13	93
-	Collision railway/bus/lorry	1	2	-	2	-	1	3	3	3	3	1	1	20
6	**Mine disasters**	3	4	2	2	1	1	2	3	1	2	2	1	24
7	**Collapse of Buildings, bridges, etc.**	1	7	2	1	4	-	1	1	2	2	3	6	30
8	**Miscellaneous**	-	1	1	-	-	-	-	1	-	3	3	4	13
	TOTAL	114	164	149	126	133	128	139	132	125	144	144	151	1651

Source: Sigma (1982), Swiss Reinsurance Company, London

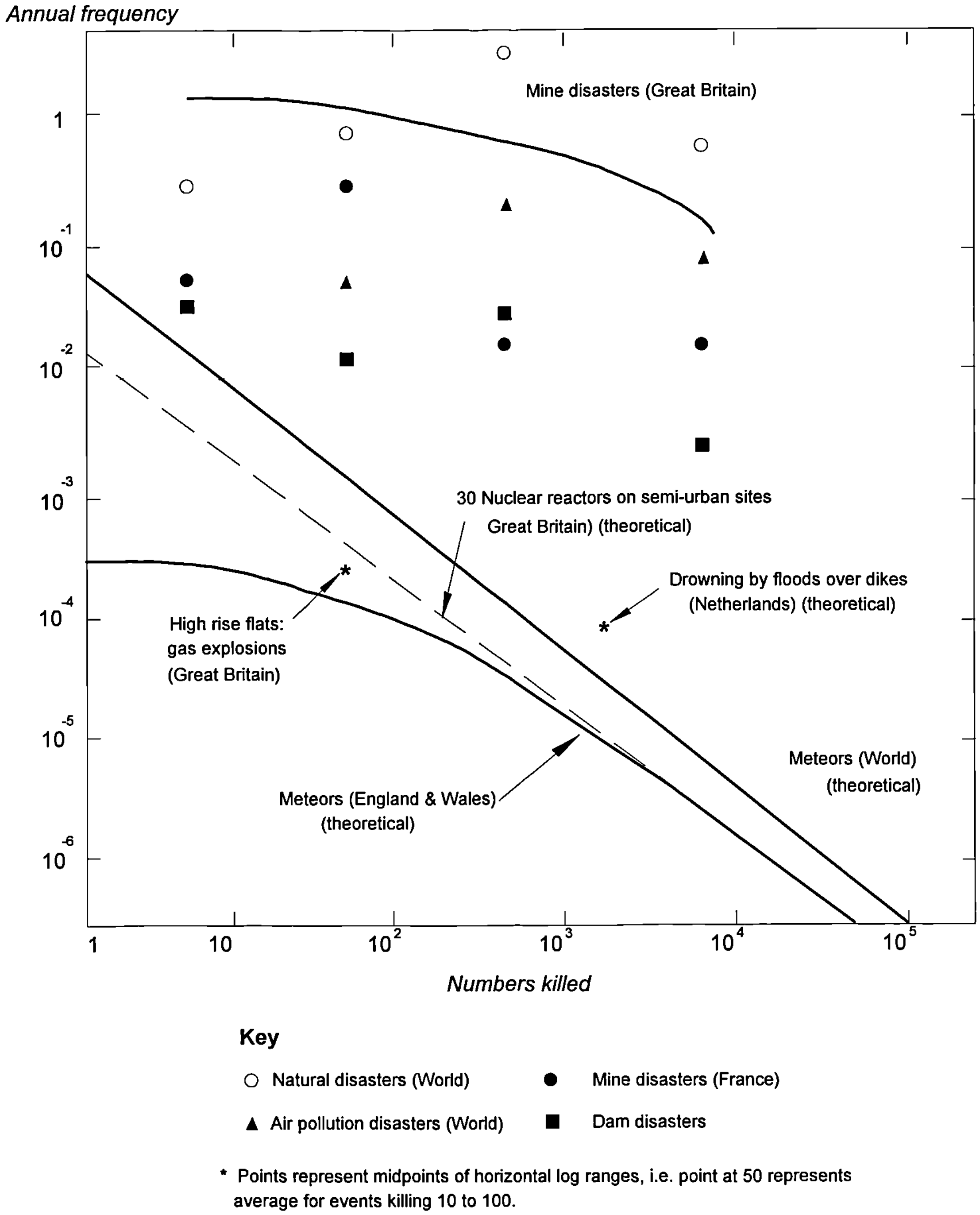
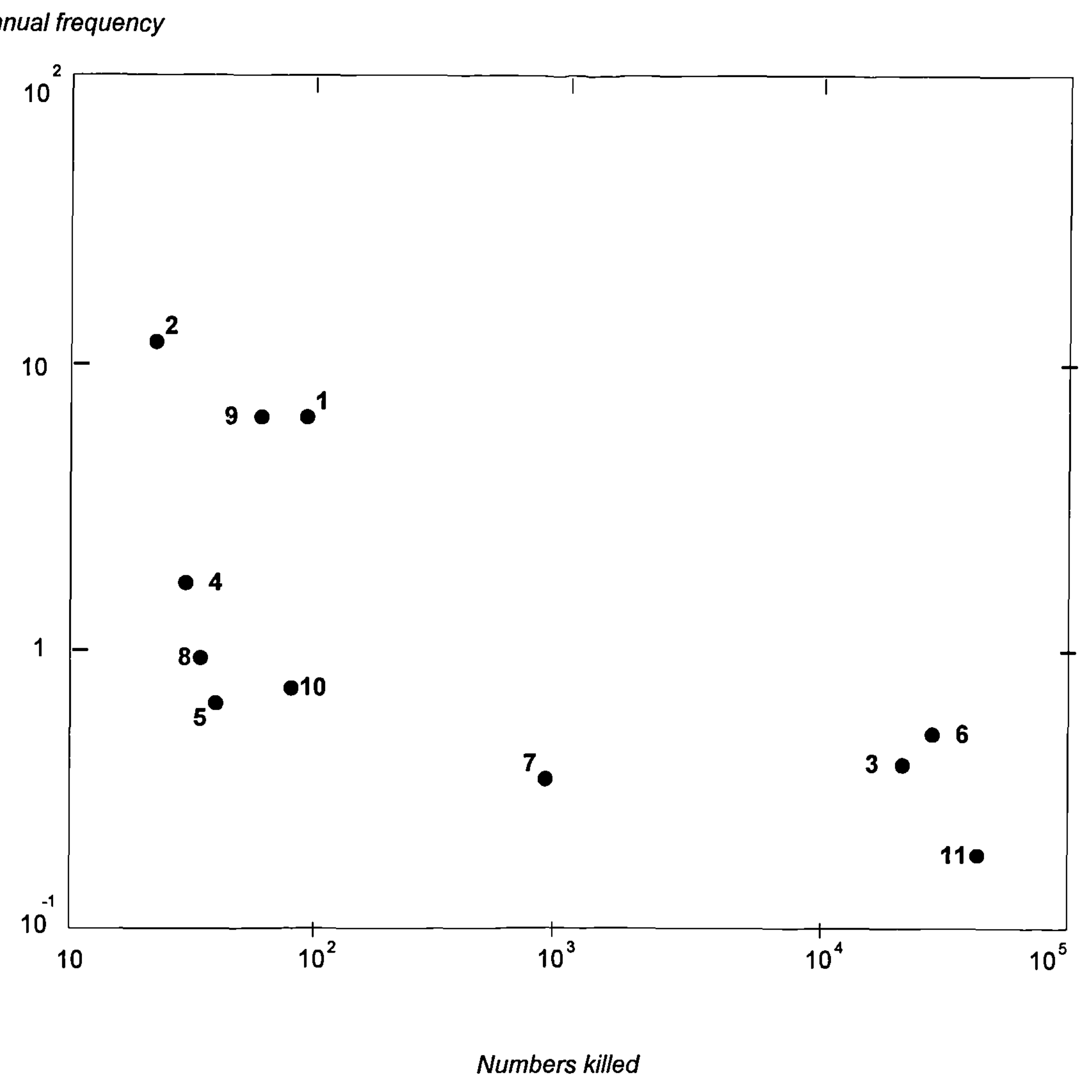


FIGURE 2.1: <u>COMPARISON OF RISKS</u>

Source: Sinclair C, Marstrand P and Newisk P, (1974)

Pub: "The Evaluation of Human Life and Safety in Relation to Technical Change", Innovation and Human Risks.



Key

1 Major air crashes	7 Hurricans
2 Makjor auto crashes	8 Major railroad Crashes
3 Earthquakes	9 Major marine accidents
4 Explosions	10 US Tornados
5 Major fires	11 Typhoons, cyclones, blizzards
6 Flood, tidal waves	

FIGURE 2.2: <u>COMPARISON OF RISK FROM VARIOUS TYPES OF DISASTER (WORLD)</u>

Source: Sinclair, P. *et al* (1974), Science Policy Unit, University of Sussex.

Pub: Innovation and Human Risk.

2.3 HEALTH AND SAFETY AT WORK

2.3.1 History

The history of Health and Safety at Work has been very well detailed over the years. Barrett and Howells (1978) state the history is mainly that of a legislative nature. Avid (1976) shares a similar view. In their review of the historical background, they explained how the industrial revolution, and the appalling conditions in which some of the children were put to work, led to the introduction of the 1802 Act. At sea, the efforts of Samuel Plimsoll contributed tremendously in sponsoring 'Bills' that protected seamen, and trade. His single-handed struggles, led to the advancement of controls over shipping, loading, seaworthiness of ships, and undermanned vessels (Turner, 1950).

The poor conditions, long working hours, and employment of children, led to enactment of the 1802 Act. Pollard (1968 p.195) says:

> "Sir Robert Pitt the Elder has put on record his horror and disgust, at the conditions of the near 1,000 children, in his family mills before persuading Parliament to pass the 1802 Act".

This Act has created so much awareness that it led to the need for further statutes in 1819, 1820 and 1831 - which aimed at reinforcing or extending the control formulated in 1802 (refer also Eva and Oswald, 1981).

In 1833, the Factory Inspectorate was established. It monitored 2,000 mills to ensure that child labour was not over-exploited (Clutterbuck, 1981). Later, in 1860, a series of surveys by the Royal Commission identified pulmonary diseases, health effects of silica dust, and phthisis (pulmonary Tuberculosis). This discovery accelerated the growth in demand for further safety measures at work.

Briefly, the history of health and safety is a long-running battle with industrialists, and those with interests in the exploitation of labour for profit. The first and second World Wars have contributed immensely to getting employers to consider the various hazards at work. Therefore, the government established Boards and Research Bodies (or groups) to investigate "Fatigue" and health in industry (initially the Industry Fatigue Research Board: later known as The Industrial Health Research Board). Roebuck, 1973, p.95:

The hazards created by new products, and technologies were increasing at a faster pace than that at which techniques were developed to control these hazards (Clutterbuck, 1980).

This historical progression has significantly developed health and safety measures in industry - pressure groups were formed to inform the public of hazards in their environment. The complexity and scale of the hazards themselves led to this outcome. A relatively high degree of awareness has been created by the information provided, and the pressures applied by these groups to inform, and alarm the public, who in turn pressurised the government into action. The impact of these pressures is clear from the legislation which proceeded, linking safety at work with public safety, and product safety (Barrett and Howells, 1978).

The Accident Prevention Unit (APAU)(1980, p.4) states:

> "There is increasing pressure from employers, trade unions and sections of the public for improved working conditions. Expectations, relating to health and safety, are rising and frequently featured as an industrial relations problem".

This demonstrates how the social, industrial and environmental climates have contributed to increasing awareness, and thus leading to increase of these pressures on government, and employer organisations to act on improving health and safety. It is pointed out that the pressures are operating in favour of safer workplaces, and better working conditions. This same report goes on to state:

> "... some sectors of Society now consider the whole range of accidents, ill-health, pollution or loss of amenity to be preventable, and are unwilling to accept technical difficulties or financial constraints as reasons for lack of control".
>
> (The Accident Prevention Unit, 1980)

Society as a whole is developing a rational attitude where the new advanced technological culture would, to a great extent, reject any irrational explanation. They are more aware of the existence of the prominent features of health and safety. This is clear in the creation of bodies, groups and associations to deal with threats facing society. The existence of laws is a source for motivating different sectors of the society to demonstrate against the threats that they are facing or likely to face. Thus, a perception of what constitutes an acceptable level of risk at any given time is generated.

In support of the above, Douglas and Wildavsky (1982, p.9) state:

> "... people select their awareness of certain dangers to conform with a specific way of life, it follows that people who adhere to different forms of social organisations are disposed to take (or avoid) different kinds of risks. To alter risk selection, and risk perception, then, would depend on changing the social organisation".

The culture, and its members are hence responsible for the pattern of development that will take place in regard to hazards, and risks.

2.3.2 The Robens Report (1970-1972)

The Robens Report marked a changing point in the history of Health and Safety in Britain. The Report indicated the increase in fatalities, injuries, and economic wastes resulting from accidents at work. New hazards, and their associated consequences were emerging. Therefore, one of the main recommendations of the report was that a revision of statutory arrangements should evolve. This was done in association with increasing the efficiency of the State's contribution to Safety an Health at Work. Also, the Report recommended that new statutory arrangements should be made to provide a framework for better control, and self-regulation by industry.

The Report called for the establishment of written statements of safety policy by industry. The full participation of employees should be fully recognised by management in relation to health and safety matters. Annual Reports should be required to include prescribed information about accidents, and occupational diseases suffered by a company's employees.

The main recommendation was the formation of a Health and Safety Executive (HSE), which is discussed in the section immediately following. This body was granted the statutory powers to prosecute, and to enforce the law in terms of health and safety infringements by individuals and companies. A special section was assigned to ensure public interests, particularly where large-scale hazards were concerned.

In the text of the Report, a section was designed to advise on a list of major risks and hazards. These risks included fire, explosives. and toxic substances, asbestos, noise, and unsafe machinery and equipment. The Report assigned what was to be done about each of the listed risks and hazards in terms of liaison between the Employment Medical Advisory Service, and the new proposed body of the Health and Safety Executive (HSE).

Finally, a list of topics related to training on safety, research and information, statistics, cost of accidents, compensation and prevention was discussed to show the need for organising and promoting these activities in the context of the new legislation.

This comprehensive Report was enforced by Health and Safety at Work Act (HASAWA) 1974. This Act is in operation throughout Great Britain. Thomas (1981) indicates that the introduction of this law has immensely influenced safety performance in the United Kingdom. This research investigated safety performance in the companies which were surveyed in this study, using questionnaires and interviews. The research was conducted over a period of five years, after the inception of HASAWA. All frequencies of safety incidents have shown a marked trend towards approaching the lower control limit in 1979. The major conclusion of this research shows that whilst the incidence rate throughout the construction industry remains unacceptably high, yet the organisations which took part in this research are shown to treat health and safety matters with more concern than they did before the Act.

2.3.3 Health and Safety Executive (HSE)

The establishment of the HSE was a major outcome of the Robens Report of 1972, and a mandatory setting up of a Health and Safety Committee with trade union representatives became part of every management's responsibilities, has the most important role of monitoring and auditing safety at work in the United Kingdom. Their role is clearly defined by the diversified structure of organisations within the body of the HSE. The organisational structure covers a wide range of activities. This allows the HSE to be involved at every level of the process of risk control. The latest organisation set up is shown in the Health and Safety Commission Report, 1984-1985.

The extent of the activities of the HSE is shown from the total net expenditure. There has been a constant increase in the expenditure of this body to meet the different requirements of their financial control (Table 2.2).

TABLE 2.2 NET EXPENDITURE (HSE) (× £'000)

Year	1980 - '81	1981 - '82	1982 - '83	1983 - '84	1984 - '85
Expenditure	73,727	78,457	86,375	91,080	93,718

Source: HSE Commission Report, 1980 - '85

Research is an activity that is fully recognised as part of the role of the HSE. Their research encompasses various hazards in different occupations. The main topics are occupational medicine, environmental hazards, engineering and construction hazards, electrical hazards, explosion, fire an major hazards. These are to occupy a period of 1-19 man-years.

TABLE 2.3: INSPECTION AND ENFORCEMENT ACTIVITY 1981-1984 FOR HSE AND AGENCY INSPECTORATES (*)

	1981	**1982**	**1983**	**1984 (p)**
No. of visits made (x 1,000) **	257	258	248	245
No. of accidents or incedients investigated (x 1,000)	17.2	18.8	13.8	11.4
No. of improvement, prohibition and Crown notices and infraction letters served (x 1,000)	8.1	7.6	8.7	8.8
No. of prosecutions	1301	1396***	1381	1267

Inspection and enforcement activity is another major part of the duties of the HSE. There are regular visits to registered premises, sites, and others as shown in Table 2.3 above. There have been cases of prosecutions which have increased in number in relation to the number of visits.

The Health and Safety Commission - a tripartite body from the government, industry and Trade Unions, sets the policy for the Health and Safety Executive. It essentially looks after procedures for factories and offices under the auspices of the 1974 Health and Safety at Work Act.

In addition, there are separate agencies under the direct control of the government offices such as the Department of Transport, and the Department of Energy which look after nuclear power, oil and gas activities, railways, airways and agriculture. In 1979, the Department of Transport set up a new agency - the Marine Accident Investigation Branch to administer safety on water. Its first task was to examine the sinking of the "Marchioness" pleasure vessel on the River Thames in London.

Since the enactment of the 1974 (HASAWA) Act, additional areas of enforcement responsibility have been given to the Health and Safety Inspectorate over the same period (1980-1985/6), as the inspection and enforcement responsibilities increased, there has been a steady decrease in both funding of the HSC (Health and Safety Commission), HSE (Health and Safety Executive), and the fall in the number of Health and Safety Inspectorates. The effect of the fall in inspection manpower has been the reduction in the number of safety visits made to construction sites, as well as other workplaces.

(TABLE 2.4). MAIN ADDITIONAL ENFORCEMENT RESPONSIBILITIES TAKEN BY THE FACTORY INSPECTORATE (SINCE 1979)

1981	The Notification of Accidents and Dangerous Occurrences Regulations. The Health and Safety (Dangerous Pathogens) Regulations. The Control of Lead at Work Regulations. The Diving Operations at Work Regulations.
1982	The Dangerous Substances (conveyance vy road in road tankers and tank containers) Regulations
1983	The Notification of Installtions - Handling Hazardous Substances Regulations
1984	The Asbestos Licensing Regulations. The Classification Packaging and Labelling Regulations
1985	Tje Gas Safety Regulations. The Control of Industrial Major Accident Hazards Regulations.
1986 ***1987*** ***1988***	Various regulations including control of the use of pesticides, and environmental pollution hazards etc.
1988 ***1989***	The Control of Substances Hazardous to Health Regulations (COSHH)

The 1982 Annual Report of the HSC underlines a drop of 6 percent (6%) in visits compared with the two previous years. Total visits in all sectors was down from 285,000 in 1979/80 to 267,000 in 1981. The reduction rate of Safety Inspectors is shown in Table 2.5 below, as published by Sylvia Collier (1987).

TABLE 2.5 SAFETY INSPECTORATE MANPOWER (1978-1986)

Year (1 April)	Factory Inspectors in HSE as a whole	Factory Inspectors in HM Factory Inspectorate	Factory Inspectors in HMFI (field only)
1978	695	642	619
1979	743	688	656
1980	759	702	664
1980	735	682	638
1982	678	620	594
1983	654	589	563
1984	627	564	539
1985	652	589	559
1986	623	560	540

Source: *Health and Safety at Work publication, Feb 1987, p.8 (Author: Sylvia Collier)*

2.4 CATASTROPHE AND THE HUMAN FACTOR

A very close look at any system will reveal the role of the human as "operator", and his contributions to the industrial processes. As a matter of fact, he is a crucial determinant of every industrial system. His/her role as the key "operator" in the industrial sector, has gained great significance with time.

Research has revealed evidence of human 'operators' being responsible for catastrophes (Howland, 1980); (Sinclair et al, 1974). Major disasters are believed to be caused mainly by 'human error'. Research by Sinclair et al, (1974) concludes:

> "...the 'conventional safety levels in nuclear stations governed by the Factories Acts are higher than in thermal power stations'. This is usually ascribed to the modernity of the buildings and the superior quality of the staff. (This latter explanation, incidentally, is also used in respect of the lower accident rates in stern trawlers as compared to side trawlers)".

They also concluded that:

> "training and education may now be the most cost-effective methods for reducing industrial accident risks in many areas".

(Howard, 1980) indicated that failures due to the human factor or more specifically, 'human error' is the result of psychological, and ergonomic factors. Reasons such as lack of motivation, low morale, incompetence, illness, accident-proneness, stress, and social behaviour, in conjunction with poor design an inadequate training are the causes of 'human error'.

Emery (1980) on the other hand, sets out clearly the theoretical relationship between risk perception an human error. If an individual does not perceive a situation as risky, then an apparently innocent decision can seriously affect the safe operation of the system. The human 'operator' is best looked upon as an 'input-output' system; (Irvine, 1980). Following Craik, Irvine concludes that:

> "inadequate training or the individual's incompetence will result in either no decision being made or, the possibility of the wrong decision being made and/or inappropriate action being taken".

Hale and Hale (1970), with their model of accident causation, clearly illustrated the effect of perceived information on action an/or decision. Perception is considered here as synonymous with 'a source of decision in risk situations'.

Swain (1982) indicate that

> "the prediction of the probability of failure of equipment components is far more reliable than the prediction of human error".

The explanation given by Swain, is that

> "humans use their intentions, needs, goal-biases, and even their emotions in their operation; factors much more complex, and difficult to quantify".

Accidents, as stated above, do not occur only due to negligence or human error(s). Ergonomic factors have an influence of some degree of importance; indeed ergonomists see this factor as one of the key causes of industrial accidents. There is a wider field of research, particularly in 'consumer ergonomics' where studies have shown that 'poor ergonomic design is responsible for accidents, (Warne, 1982) (Wilson, 1979) (Singleton, 1974). Some other relevant ergonomic tests are used to avoid further product liability hazards (Wilson et al, 1980).

A more recent comprehensive research into the contributions of ergonomic design to accidents was undertaken by Adams et al, 1981). A five-year analysis of industrial injuries showed that poor ergonomic design is directly or indirectly responsible for industrial injury.

Earlier, a study by Cherns (1966) had outlined the main topics related to accidents at work. The most relevant aspect of this work, is the social aspect of accidents. A review of research that explains accidents in terms of social attitudes and values was well detailed. A most recent review of literature in 'Safety Psychology' is that of Dunn, (1971).

2.5 ACCIDENT AND DEFINITION

As man has become more willing to utilise scientific techniques to the study of human behaviour, human attitudes towards risks and accidents have undergone a considerable change. They are no longer regarded as entirely due to chance, and one of the inevitable prices to be paid for technological advancement, and innovation. Events which were previously viewed to be determined by chance are now considered as avoidable or indeed, preventable; and causes which were originally considered to be beyond individual control, are now viewed to be related to an individual's psycho-physiological make-up.

Freud (1915-17) directed attention to the destructive, or indeed self-destructive, unconscious wishes underlying some kinds of accidents. The classical statistical enquiry into what happened to women munitions workers in the process of manufacturing shells, by Greenwood and Woods (1919), set the scene for serious scientific investigations into accident occurrence.

In the majority of research papers reviewed, the synonymous notion of accident and injury are discussed. However, the term 'accident' is generally defined in dictionaries as "without apparent cause"; "an unplanned event"; "unexpected"; "unintentional act"; "a chanced event"; or even "mishaps". Others describe accidents as "An Act of God", as stated above in this chapter. From the above, it would seem that the word "accident" has different meanings to different people, and hence, researchers of 'accidents' have had to provide their own definitions to delineate their own interests. Furthermore, the papers reviewed in this chapter define accidents in different ways. It has been suggested that if researchers define 'accidents' in a number of different ways as stated above, such definitions must affect the findings of their research (Vant J, 1982). Vant stated that: "A major difficulty facing those investigating accidents is the nature of the accident itself". Churns (1968), describes an accident as: "an error with sad consequences". All the same, many similar errors have no significant consequences; it is these near-accidents - the near-misses - which mostly go unrecorded and therefore unexamined or analysed for future actions. Any factor tending to discriminate between damage-causing accidents, and those without any consequences must have the effect of inhibiting true scientific enquiry into safety generally, and more particularly safety in the workplace (Vant, 1982).

Whilst "Act of God" is as stated above, attributed to major accidents, it is used to give interpretation to causes of accidents which are not clearly understood or analysed by accident investigators. Such accidents are those where causes are difficult to explain by scientific means.

The term "Act of God" originate in marine policies, which then transferred over to land insurance

(Schmidt, 1976). The phrase is mainly attributable to 'Third Party Liability' (who is to blame ...?). The legal profession uses the concept of "Act of God" in order to prejudice a case in favour of their client.

The insurance professions have in a series of publications, defended what they have referred to as the "Act of God Fallacy". They have clarified that it is neither excluded from the insurance policy nor implied as being excluded by common law, (Features, 1981), (Vant, 1976), (Student Special, 1975). The degree of negligence associated with the case is the judged liability. Whatever justification the professionals give, it is still widely used as an outlet, and may provide an excuse to avoid compensate and/or liability. The Dictionary of Insurance (1980) defines an "Act of God" as:

> "An event that is the result of natural forces arising without human intervention and which no human foresight could have provided against".

This study accepts the premise that accidents in the construction industry are the result of human intervention with his/her work environment, and that human or individual attitudes play a part in accident occurrence. From this, it assumes that accidents in the construction industry are preventable, or avoidable, and not left to chance or "Acts of God".

If the above definition of "Act of God" is accepted as valid for such a term, then it could be argued that such a phrase has no place in construction related accidents. This is because construction accidents are man-made, due to the presence of the human factor in relation to its working environment. As such, human intervention, and human forethought and foresight, remain the key to accident prevention through the design and implementation of safe systems of work, and through training and education.

From the above, we may conclude that the above definition of "Act of God" in a world where people should be trained and educated is probabilistic and not deterministic (Slovic et al, 1980).

2.6 CLASSIFICATION OF ACCIDENTS/SAFETY

Studies have been undertaken over the years, in the field of accident research, and the review undertaken by Hale and Hale (1972), indicated that most are based on:

(a) the relationship of individual factors to accidents, and
(b) personal as opposed to environmental factors.

Several researchers have attempted to provide a classification of accident motivators. Fleishman (1946), attributes four contributory causes:

(a) situational;

(b) mechanical;
(c) human, and
(d) chance.

Blum and Naylor (1968), have examined accidents in terms of physical and psychological factors.

Leather (1983) examined accidents and safety in terms of:

(a) environmental (structural) factors, and
(b) psychological (individual) factors.

Environmental (structural) factors were defined by Leather (1983) as

(a) site conditions (eg. 'access to work' etc.);
(b) site tidiness;
(c) availability of technical resources;
(d) inter and intra-group co-operation;
(e) control and supervision of work activities;
(f) effectiveness of long-term planning;
(g) role and position of the safety officer, and safety representatives, and
(h) pay structure.

Psychological (individual) factors were defined as consisting of the following:

(a) care an attention on the part of individuals;
(b) skill an experience brought to the job;
(c) safety training;
(d) origins of safety norms;
(e) accuracy of subjective risk-evaluations;
(f) perceived responsibilities;
(g) feelings of competent autonomy or fatalism.

These factors, according to Leather (1983), were found from the operatives studied, to be amongst the key problems affecting the individual's safety attitudes, and risk perception in the construction industry. He indicated that the "potential accident subject" (which is the individual who, by his/her presence on the construction site, is the potential accident victim, or is the potential accident contributor, and not necessarily the victim). He concluded that the person present on-site is therefore the subject of a set of inputs of information or influences (which may be good or which may inculcate unsafe practices), leading in turn to outputs represented by his/her attitudes and consequent behaviour. This study also found that a degree of difference in attitudes' existed between workers in the private sector of the industry and the public sector. Other dominant items in safety promotion were organisational features, such as:

(a) bonus systems;
(b) the provision and maintenance of safety equipment, and
(c) general working conditions.

Artherley (1975) proffers that: "Accidents are caused by human elements and human error". He concludes that:

> "changes in attitudes and changes in human behaviour can reduce human error, and the human elements in accidents".

Therefore: "efforts to advance Health and Safety at Work, should be directed towards altering workers' attitudes, and including safe behaviour". (Artherley, 1975).

Hale and Hale (1972) share a similar view. In their review of Accident Research Literature, they identified 355 research studies, all concerned with human error, as a cause of accidents. They however, made it clear that "clear-cut findings are few and far between". Nevertheless, they concluded:

> "All Health and Safety strategies have human involvement. Therefore attitudes and behaviour of employers, managers, workers (operatives etc), and specialist, are crucial in the implementation of safety strategies. From health and safety specialists' point of view, an understanding of human attitudes and behaviour may be the most crucial factor in getting appropriate strategies adopted and maintained".

Pirani (1976), found that whilst workers were reluctant to wear safety protective clothing, safety unawareness was far more to do with personal attitudes than anything else. He suggested that the only way to counter such individual negative attitudes was to persuade people to wear safety clothing through the use of a "poster campaign" or "fear techniques".

Janis and Fleshback (1953) have investigated the effectiveness of fear-arousal communication in the United States of America. They concluded that:

> "the use of strong fear-appeals interfered with the overall effectiveness of a reasoned approach.

Kay (1978) has indicated that:

> "Where society has made a deliberate intervention in any specific type of event to

influence accident rates, it has often succeeded".

He indicated three factors most likely to cause accidents:

(a) the individual himself, who causes the accident;
(b) the risks inherent in the work itself; the skill of the worker, and design of the work;
(c) the working-social environment;
accidents, and absenteeism; physical factors, eg: lighting, temperature, noise, stress, fatigue, alcohol, age, safety, propaganda and training.

He concluded:

"common to all three areas (as above), is the behaviour of the individual which we have not identified separately (p.104).

In Kay's summary, he expressed the view that:

"Different kinds of behaviour are often placed in the same category, only because they have the same outcome - they result in an accident. Exactly similar actions which do not lead to accidents may not be associated. If we are to understand accidents, we need to investigate the relationship between behaviour which results in accidents; behaviour which potentially might have resulted in an accident, and everyday actions. ... an outstanding feature of many accidents is that 'a person has to switch from operating in a pre-programmed mode to an environmentally controlled (stimulus-response) mode' etc".

Apart from studies into the factors most likely to cause accidents, there have been suggestions that:

"Studies on attitudes to work must focus on the links between attitudes and actions; but that the argument on attitudes is based in most cases, upon a recognition that behaviour is multiply determined".

Kay concludes that:

"It is inappropriate to seek single determinants, for example, in terms of attitudes alone; since a range of social, environmental and personal factors also come into play. In some cases, attitudes may be the dominant influence on behaviour, but on other occasions, they will be of minor significance.

Several studies have shown that behaviour may also generate or change attitudes, particularly in role-playing. The indicate that there may be a circular relationship over time; or that attitudes may interact with other features in complex causal inter-dependencies (Shimmin et al, 1980) (Kelman, 1974).

Kelman stressed that:

> "action is the ground on which attitudes are formed, tested, modified, and abandoned".

Shimmin, in discussing the issues concerning the relationship between attitudes and action, concluded that:

> "If safe construction is to be achieved, it will be necessary to change the attitudes and perceptions of both managers and men, and the structural features which inform these attitudes".
>
> (Shimmin et al, 1980)

She stated that:

> "managers should realise that they must make every effort to ensure that safe working conditions begin at the design stage, and are not jeopardised by poor site co-ordination. They also need to give full safety training to all their employees so that they develop an accurate subjective risk model. Workers should realise that safety cannot be thrown aside for higher pay and, while recognising that their supervisors are legally bound to ensure their safety, they need to press more forcibly for safe working conditions rather than acquiescing in bribery to take risks".

Socrates (1978) also emphasised the role of human factors in accident causation. He stated:

> "Generally, accidents at work occur either due to a lack of knowledge or training, a lack of supervision, or a lack of means to carry out the task safely, or alternatively, due to an error or judgement, carelessness, apathy or downright reckless indifference".

Stressing the need for employees to take a more positive attitude towards working safely and avoiding accidents, he concluded:

> "In examining the accident statistics of the construction industry, it is quite obvious that it is this problem of mental attitudes which needs to be overcome; given that all machines and buildings are designed to be as fool-proof and vandal-proof in the safety aspects as possible".
>
> (Socrates G, 1978/80)

Over the years, several researches (as documented above) have identified the numerous human factors which lead to accidents in the work station. Nevertheless, there exist only minimal agreement amongst psychologists on the easiest ways of approaching the issue of attitude-change. Whilst most agree that much emphasis should be placed on training, education, and role-playing as ways of improving or changing attitudes, Sinnott (1978) highlights a major problem facing the use of teaching to change attitudes to safety. He argues that one of the first difficulties to overcome in attempting to change safety attitudes through teaching or education, is:

> "the ambivalence of society's attitude to danger; it demands protection, but despises anything that smacks of fearfulness or timidity. It went on to state that "all societies admire bravery and risk-taking, and the basic reason for this is that the survival of the group is more important than the survival of an individual". Thus, individuals are encourages to put themselves at risk if this is likely to benefit the group as a whole".

He asserts that because brave behaviour is admired, people will seek admiration by displaying to their peers and to the world at large that they are not afraid to take risks. As a result, they disdain the wearing of seat belts, eye protection, and even of safety protective clothing, including safety helmets and industrial safety boots (Sinnott R, 1978).

Various writers on the influence of 'peer groups' and the theory of risk-taking, have suggested that such behaviour cannot be confirmed as standard behaviour for all circumstances in the perception of danger or risk (Glendon, 1983) and (Shimmin, 1980). He proposes the following course of action for improving people's ability to recognise dangers - both to themselves and others:

(a) Research into the nature of hazards (hazard identification).
(b) Effective transmission of scientific knowledge.
(c) Understanding of hazards (cognition being essential to learning).
(d) Knowledge of appropriate action(s).

It is also suggested that the main problems likely to be associated with improving hazard-recognition include the following:

(i) **Perception:** many hazards are not easily perceived, particularly health hazards;
(ii) **The gap between the levels of knowledge:** personal experience, and statistical fact (or artefact!);
(iii) **Development:** once acquired, individual perceptions of, attributes towards, and behaviour in respect of danger are likely to be relatively resistant to change.

(Glendon, 1983)

Leather (op cit) (1983) on the other hand, believes that the many dangers and hazards in construction work require considerable care and attention if they are not to lead to accidents. He contends that there are many other factors in the construction industry which might easily be said to run counter to the need for a high safety awareness. Such factors include the following characteristics of the industry:

(a) The need to avoid penalty clauses for late contract completion;
(b) The unpredictability of the weather, and
(c) Operator's desire to maximise bonus earnings.

He argues that 'since time is put at a premium by all these factors, the time spent on safety precautions and forethought, is put into an acute balance with production time. In short, there is a competition or conflict between safety and production as claimants upon time, and this conflict must somehow be resolved both practically (achieving some degree of efficient organisational production) and psychologically (achieving some degree of personal satisfaction with the job and its rewards).

He concludes:

(1) "Any self-based attitude wherein the major input to safety is a reliance upon the individual work experience of the operative - regardless of either organisational constraints or any systemised safety training - can clearly be seen to provide this kind of resolution.

(2) ... those major attitudes to be found in the construction industry, are those which are most successfully fostered by its relevant "rewards and punishment". For example:

- the reliance upon bonus payments to bolster individual earnings;
- the threat of penalty clauses;
- the "macho" image of the tough;
- the "dare-do-all" building worker;
- the problems created by adverse weather conditions etc.

It is these and other factors like them which combine to reinforce certain attitudes towards safety and risk-taking. The attitudes are born of the reinforcement. It is the latter which may well hold the key to any effective attitude change. Indeed, attitudes will not change until such desired change is clearly and readily reinforced within the day-to-day workings of the construction industry".

(Leather, 1983)

Wilkinson (1975) however, suggests that for anything to change for the better in the field of safety of people at work, then everyone connected with it must change their attitudes. He makes the following conditions for attitude change in construction to take place.

(a) Safety Managers must learn to talk about safety to their superiors in top management terms if they are to get attention.
(b) Safety Representatives must learn how to persuade rather than simply use pressure.
(c) Supervisors must realise that the correction of an unsafe situation is primarily their responsibility in the first place.
(d) Employees must realise that if they see unsafe situations, they should ask their supervisor to have them corrected, and
(e) Managers must realise that any unsafe situation is a potentiality for loss, degraded profit and disgrace.

2.7 SAFETY TRAINING AND PROPAGANDA

The three ways of preventing accidents, as identified by the Accident Prevention Unit (APAU, 1980), are:

(a) by making the working environment as safe as possible;
(b) by protecting the worker from the remaining hazards by means of suitable protective clothing and equipment; and
(c) by training him/her to act in a safe way at all times.

The principal player in all the above is the human factor. For the human factor to eliminate or prevent accidents, we must first be aware of what the causes of accidents entail in the work environment. Hazard identification and assessment are considered to be highly significant factors in attitudes towards risks in general, and safety performance in particular (Robaye, 1963) (Hale and Hale, 1970).

A point of view generally held by safety advisers/officers and as evidenced by previous research is that, the results of hazard identification and assessment exert considerable influence upon the choice of a type of action taken (CITB, 1972; APU, 1980). Lawrence (1974) shared a similar view. Hale and Hale (1972) proposed that such a view was implicit in most safety propaganda. They stated that, such propaganda is aimed at influencing a person's assessment of a hazard, or attitudes towards a safety environment. The underlying assumption is that by identifying the hazard, or potential hazard, people will change their assessment caused by a prior hazard identification, and this could lead to an attitudinal/behavioural change (Hale and Hale, 1972).

Similar theses underlie some forms of safety training in the construction industry (CITB, 1972).

When the hazards of a similar work situation, and the severity of their outcomes are described to new entrants to the industry, it is assumed that their behaviour towards safety will be influenced in the way described above (Hale and Hale, 1972) (Aldridge, 1976).

Miller and Agnew (1973) and others, hypothesised that "the hidden benefits of first-aid training, impinge upon some assumptions or thesis". They assert that first-aid training leads people to become aware of the range and of the severity of injuries which can result from certain situations. It is also asserted that this new awareness, alters people's assessment of those safety situations, and hence their behaviour (Miller et al 1973; Artherley et al 1973; McKenna, 1978).

The aim of safety training and safety propaganda, is to influence safety behaviour generally, but more particularly, in the face of dangerous situations. It is therefore assumed that such influence can be achieved by a change in hazard identification, and hazard analysis. The essence of the efforts made to modify hazard analysis therefore, may well depend upon what is known about hazard identification, and hazard assessment, in terms of safety training, and safety propaganda.

2.8 SAFETY PERFORMANCE

Safety performance is viewed mostly within the context of accident occurrence. A recent report suggests that "most discussions of safety performance seem in the main to centre round accident statistics" (Accident Prevention Advisory Unit (APAU, 1984) of the Health and Safety Executive. The report however, pointed out that 'accident statistics are only one index of safety performance, and that they are an index of failure.

Morgan and Davies (1981) suggests that 'for every major injury accident, there are ten property damage accidents, and for every property damage incident, twenty near-misses'. It concluded that the objective for conducting safety audits, is to reduce the number of hazards, and thereby reduce the number of accidents.

The HM Factory Inspectorate (HMFI) during 1981, 1982 and 1983 had shown that of the 1186 fatalities during those years, reasonably practicable precautions were not identified in 192 cases, and that a further 34 could not be classified. Of the remaining 960 cases, 576 were considered to have been influenced by a secondary cause. The report pointed out that when an accident or incident occurs, management blames the employee, and issues edicts that the worker should take more care. The worker on the other hand, will argue conversely. As a result of these diverse arguments, 'APAU' therefore makes a judgement as to who is primarily responsible. This judgement made against the background of HASAWA (1974) places the prime responsibility for compliance with legal requirements on the employer. As such, any analysis would show that responsibility for failure rests principally with senior management.

Analysis of the 960 accidents indicated above, showed that senior management was responsible for 61 percent (61%), work people for 18 percent (18%), and joint responsibility between workpeople, and management, for 12 percent (12%).

The report went on to specify the role of accidents and incidents in the measurement of safety performance, and prescribed that incident-reporting should define the following:

(a) Personal injury accidents;
(b) plant/property damaged incidents;
(c) dangerous occurrences, and
(d) near-misses.

> "The purpose of monitoring safety performance is to ensure the proper and economical use of resources which will show dividends not only in regard to the accident and ill-health record, but also in the efficiency of the firm".
>
> (APAU, HMFI Report, 1984)

Westerlund (Stockholm, 1954), whilst commenting on productivity factors, stated that:

> "... series of measures could be classified as more or less indirect productivity measures. Such would include absence figures, labour turnover, medical data on the workers, number of accidents, number of grievances etc".

He suggested that:

> 'it is difficult to measure directly the amount of energy expended in a situation, or satisfaction given up or found in a situation, and consequently, the ratio output over the kinds of input can hardly be ascertained'.

He concluded:

> "Labour turnover like numbers of accidents and absence figures may be the first readily recognisable indicators of an undesirable development in the audit or measurement of safety performance".
>
> (Westerlund G, 1954)

Brayfield and Crockett on the other hand concentrated their research on the attitudes and performance of employees in the work situation. They hypothesized that "Employee attitudes bear a significant relationship to employee performance". Their premise was that it was of some practical and theoretical interest to establish the relationships which exist between employee attitudes, and employee performance. According to Brayfield and Crockett, any research into employee attitudes and employee performance must satisfy certain established conditions. Such conditions were as follows:

(a) the indices of employee attitudes must permit classification of respondents along some attitude continuum;

(b) the indices of employ attitudes must have been obtained directly from the employees themselves, and

(c) the investigation must have been conducted in industrial or occupational settings.

They concluded:

> "Whilst ratings of job performance by supervisors and others are useful (if no other criteria of performance are available), nevertheless, estimates of attitudes by someone other than the individuals who attitudes and performances are investigated remained invalid, and insignificant".
>
> (Brayfield and Crockett, 1955)

One of the classic studies relating attitudes and performances in an industrial setting was conducted by Kornhauser and Sharp (1930), in Neenah, Wisconsin (USA). The study was conducted in the mill operated by Kimberley Clark Corporation (as reported in Brayfield and Crockett, 1955). The study was based n a population sample of between 200 and 300 young girls engaged in routine repetitive jobs at machines. Both questionnaires and interviews were used. The findings on the relationship of attitudes to performance is summed up in the statement that:

(1) "efficiency ratings of employees showed no relationship to their attitudes".

(2) No description was given of the rating system. With respect to the criterion of withdrawal from the job, Kornhauser and Sharp reported that "unfavourableness of job attitudes is slightly correlated with lost time because of sickness".

Hill and Trist (1953) in their investigation 'A consideration of Industrial Accidents as a Means of Withdrawal from the Work Situation', suggested that:

> "Accidents [may] be considered as a means of withdrawal from the work situation through which the individual may take up the role of absentee in a way acceptable both to himself, and to his employing organisation".

Accidents are considered to involve the "quality of the relationship obtaining between employees and their place of work". In an empirical test of this hypothesis, Hill and Trist found accident rates to be positively associated with other forms of absences, and to be most strongly associated with the least sanctioned forms of absence. They contended that:

> "The level of accidents sustained in any working organisation has been held to

> depend on the interaction of two major groups of factors. On the one hand, are what may be called the "opportunities" for accidents - the actual risks and hazards of the job; on the other, the propensities of individuals to take these opportunities, that is, to have accidents".

They asserted that:

> "Current remedies tend to concentrate either on blocking up the opportunities for accidents in the physical environment (for example, by guarding machinery or prohibiting access to certain areas), or an attempting to reduce the propensity of the individual employee to take these opportunities (e.g. by accidents propaganda and the campaigns of various kinds, or by selection or training)".
>
> (Hill and Trist, 1953)

For several years, the construction management programme at Stanford University (USA), studied people's problems in construction. However, in 1973, their research programme placed emphasis on how management could affect safety performance on construction sites.

Hinze and Henry studied superintendents (as part of the above programme), to see their effect on the frequency of injuries on their construction sites. The study investigated how work practices on job policies of these field supervisors affected the safety performance of workers on their projects. Information was obtained through interviews on:

(a) General job management practices.
(b) Job safety policies.
(c) Safety attitudes of the supervisors, and
(d) the general descriptive information about their jobs.

The measure used to evaluate the safety performances of the superintendents was the number of recordable injuries that had occurred to their workers. Comparison were made between the supervisors by developing a ratio that represented the total number of recordable injuries that had occurred in each man's operatives per 1,000,000,000 man-hours of operative exposure. The research concluded that:

> "Good safety performance and high productivity are compatible; one does not have to sacrifice one for the other. Good safety performance is also related to management styles, and that applying excessive pressure by any means to the workmen resulted in increased injuries. Excessive pressures do not contribute to better productivity; only injuring more people".
>
> (Hinze J, Henry Parker W, (1978))

Most management surveys on safety performance insist that management cares about workers' health and safety in industry and give many reasons to justify their feelings of care (Revelle J B, and Boulton Lola, (1981), Workers' Attitudes and Perception of Safety", pub. 'The Professional Safety Manager' pp28-35). The concluded:

> "The sick or injured employee is not productive; in fact he is counter-productive in terms of time lost, and increased costs to the employer for medical insurance, workers' compensation, increased staffing, and decreased efficiency".
>
> (Revelle and Boulton, 1981)

In most industrially developed societies today, legislation requires the employer to provide 'employment and a place of employment which are free from recognised hazards that at causing or likely to cause death or serious physical harm to employees' (Public Law 91-596 (USA, 1973), (Health and Safety at Work Act, 1974, UK).

These requirements in both countries have had the effect of spurring management attention, organisational skills, and scientific research on the subject of worker and workplace safety and health. Employers' organisations and industrial associations provide forums for collection and dissemination of information on occupational safety and health, towards the goal of understanding and eliminating workplace risk(s).

Revelle and Bulton's (1981) study on 'Worker attitudes and perceptions of safety' had assumed a working definition as a result of continuing observation such as "an awareness is developed, as a tendency to behave in a particular way regarding safety". Their study attempted to learn about the role of beliefs, and behaviour on safety. In order to do that they endeavoured to find out:

1. Do workers think about safety?

2. What do they think about safety in regard to:

    (a) Government involvement in their workplace safety.
    (b) Company practices in training and hazard prevention.
    (c) Management attitudes as perceived by the workers.
    (d) Co-workers' concern fr themselves and others.
    (e) Their own safety on the job.

3. What do workers think should be done, and by whom, to improve workplace safety?

Their study did not formulate any hypothesis in advance. Instead, they considered their survey strictly as a fact-finding project. They designed a questionnaire to draw out the employees' attitudes and perceptions of various conditions affecting his safety on the job.

The questionnaire was arranged in sections with groups of questions relating to 'government', 'company', 'supervision', 'co-workers', and 'the individual himself'. An analysis of the returned questionnaires revealed the following conclusions:

1. **Government versus Company**

(a) Worker expectations regarding government, and company involvement in workplace safety is about even in agreeing that both have gone about the right distance in making the workplace safe. Workers expect more participation from their companies in this regard than from their government by a margin of almost two : one.

(b) Workers in small companies seemed to be more satisfied with all efforts towards workplace safety than those in large companies. They felt that 'this could be the result of the closer rapport between employers and employees in small companies where the owner/manager often works alongside the others, and all are on first-name terms'.

2. **Government and Safety**

The major and common criticism voiced regarding government involvement in safety is the same as those criticisms regarding government involvement in any area of life. These were:

(a) Bureaucracy;
(b) Unnecessary Regulations;
(c) Improper application of standards;
(d) Lack of proper monitoring and enforcement etc.

Probably the most interesting revelation about these comments is that, half of them were made by workers (and not management) who feel that the government has not gone far enough in regard to its involvement in making the workplace safe. Also for each person who feels the government has gone "far enough".

The overwhelming consensus was for:

(a) more frequent inspections;
(b) stricter regulations;
(c) monitoring, and control etc.

Twenty five percent (25%) of workers also think the government should be more involved in the handling, and disposal of hazardous wastes in industry, eg. chemicals, asbestos etc.

3. **In-Company Safety**

Workers clearly expect more involvement by their companies in workplace safety than they are getting. For each worker who is satisfied with his company's participation, there is another worker who thinks his employer should be doing more.

4. Supervisor and Safety

The importance of management's visibility, and participation in achieving successful safety scheme performance cannot be over-emphasised. Safety literature is full of such evidence (Levy and Green, 1962).

> "Employees have clear-cut ideas about their company's safety activities, and this perception of management's interest and efforts in safety not only strongly influences his behaviour but also his actual ability to learn from, and respond to safety media".
>
> (Levy and Green, 1962)

Davies and Staehl (1964) found that:

> "frequent daily contacts between workers, and supervisors on safety, and other job matters, is most important to accident control efforts. Top management's attitude towards safety is also a significant factor".

National Safety Council (USA, 1966) stated that any safety scheme must always start with top management. Whilst Stafai-Sahrai (1971) found management in general to be highly interested and involved in plant safety, others have indicated that 'low-rate plants have a greater commitment to safety schemes'. This commitment is found to be the result of a greater personal involvement by management, and greater plant resources available for, and already committed to in-plant safety and health (Smith, 1975).

The Accident Prevention Advisory Unit also reached a similar conclusion, when they reported that:

> "A strong management commitment to safety, and a motivation to work towards the attainment of high safety standards are common factors in low-accident rate plants".

They also found that extensive formal and informal contacts between workers and management on safety issues enhance the achievement of low-accident rate plants. (APAU, 1976, HSE).

Barrow (1977) on the other hand found that "the employee's attitude towards his supervisor, and his company, is one of the primary factors determining his [safety-related] behaviour".

Various studies on the subject of safety attitudes and performance over the years agree on the role which management's support, involvement, and commitment has on the efficiency, and success of any safety performance scheme. Most conclude that:

> "Management's commitment to safety, that is, its overt concert and support for safety activities within the company, represents a dominant factor in any successful safety experience in industry".

Also that:

> "this involvement, support, and direction of top management is the catalyst which is absolutely necessary to make safety and health schemes work".
>
> (Cohen, 1977; Re Velle and Bates, 1977; Zohar, 1980)

Kinsler (1979) reached similar findings, but went further to state that "ultimately, the supervisor is the 'linch-pin' of any successful safety programme".

In 1972, a study reported by Don Peterson measured 'employee perceptions of the effectiveness of safety media and of management's interest in safety' at Lozier Corporation in Omaha (USA).

In 1976, a study was conducted at the Skinner Macaroni Company, also in Omaha (USA), to determine the effectiveness of the company's safety scheme (as reported by Re Velle and Bates, 1977 (ref. Conclusion above)).

Dov Zohar (1980) (of Israel Institute of Technology in 1978), measured the safety climate of twenty factories in Israel by testing employee perceptions about the relative importance of safe conduct in their behaviour on the job(ref. Conclusions above).

Abeytunga and Hale (1982) conducted research on supervisors' perceptions of hazards on construction sites in the United Kingdom (reported in the 20th Annual Congress of the International Association of Applied Psychology, Edinburgh, July 1982).

A most recent study based on similar parameters as the above studies is that the Phil Leather (1983). He stated that:

> "the general trend in the mean sources to affirm safety as a joint undertaking between self (individual), workmates, and management; the perception of safety, is a shared responsibility".

Leather's study revealed the following findings:

(a) More than fifty tree percent said that their supervisors never talked to them about safety.

Of those whose supervisors talked to them about safety, fifty two percent thought they were merely following instructions; while the rest felt the supervisor was serious about the subject of safety.

(b) Supervisors who never talked to their workers about safety are also never seen conducting a safety inspection.

Supervisors who do talk to their employees about safety are observed differently regarding the conduct of safety inspections, depending on whether the employees perceived them to be serious about safety or just following instructions. The serious-about-safety supervisors are seen as conducting safety inspections almost three times as often as the instruction - following supervisor (41 vs. 61 percent). Conversely, the instruction-followers are also perceived as not inspecting for safety, three times as frequently as the safety-serious supervisor (52 vs. 17 percent).

(c) Supervision is more concerned with production than with safety and sometimes forces workers into unsafe conditions.

Re Velle and Bates (1977) pointed out this problem when they also concluded that "too often, line management perceives that safety and production are of necessity, mutually exclusive".

(d) Supervisors do not possess enough knowledge of equipment and procedures to be aware of unsafe conditions.

(e) Supervisors do not listen when workers report unsafe conditions.

(f) Supervisors do not act to correct unsafe conditions when they are reported, etc.

Where safety performance and its improvement were concerned, Leather concluded:

> "Given that personal experience of an accident is apparently a major cause of attitude change, significant improvements in safety might be achieved by relaying to non-victims, the frequently horrifying results, the effects of construction accidents. In other words at operative level, propaganda aimed at increasing safety consciousness and performance through a heightened awareness of the consequences of an accident is more likely to be effective when presented in terms of personal experience than in the form of accident statistics".

A study by Hinze (USA, 1978), entitled 'Turnover, New Workers, and Safety' also found strong connections between workers and supervisor's longstanding working relationships. The following findings emerged from the study:

(a) Superintendents whose operatives had fewer injuries per 1,000,000 man-hours of exposure were those having larger percentages of workers transferring with them from one job (site), to the next $p<0.001$). In other words, the safer superintendents were those who had a smaller percentage of their workers with whom they had no familiarity, that is, they knew more of their workers from prior projects.

(b) The superintendents who keep, or transfer more of their workers from a previous job have a better safety performance ($p<0.05$). It is customary for superintendents on these types of projects to move several hundred miles from one job to the next.

(c) Companies with better safety performance records are those that have a greater percentage of their workers employed with them for more than one year ($p<0.06$).

This is particularly true when workers are employed for longer than five years ($p<0.001$). The results show not only that the safer companies are those that keep their employees for over one year, but also that there is considerable benefit in terms of safety when employees are kept for even longer durations.

(d) High employee turnover is directly related to the frequency of job injuries.

It could be inferred that the frequency of job injuries increased directly with the number of new workers in the workforce. For example, if a company has a high incidence of worker turnover, it is faced with the problem of recruiting (or hiring in the case of labour-only sub-contractors), new workers.

If the number of workers in the company is maintained at some constant level, an increase in turnover rates also increases the numbers of new workers that are recruited or hired.

Note: New workers are defined as "those who are new to the particular company or the job supervisors, or both". Consequently, the term 'new worker' defines a much broader spectrum of workers in the construction industry than in other industries.

(e) Turnover and new workers influence construction safety, and they are related problems.

(f) Reduced turnover has a beneficial impact on safety performance. With reduced turnover, there are also fewer new workers. The problem of turnover and new workers is essentially solved when most workers are retained on the company payroll for extended durations.

(g) The foreman's manner of dealing with new workers had a strong influence on the safety record or performance of his operatives or workers. Safer foremen were those who asked many questions of the new workers ($p<0.01$). This policy is one way by which the foreman can express an interest in and a concern for, the new worker. In communications with these new workers, the safer foreman would not consider safety as being separate from the work to be done ($p<0.05$). In addition, the safer foreman watched new workers closely during their first few days on the job ($p<0.05$).

(h) The foreman under the safer superintendent gave careful attention to the new workers during their first few days on the job-site. In addition, they instructed the new worker on matters of job safety.

(i) A direct involvement between top managers and new workers is beneficial to company safety performance ($p<0.05$).

Note: These tended to be small firms, so there were generally not enough employees to prevent this type of interaction.

(j) With regard to the new workers, the safer firms were those having trained or orientation programmes for the newly recruited workers ($p<0.0002$). In addition, the safer companies were also those that had a programme of formal orientation for their new foreman ($p<0.005$).

(k) Finally, the study shows that management at any level plays a vital role in the safety of new workers (recruits). Consequently, every level of management can be instrumental in reducing worker injuries and achieving a high level of safety performance at all company levels.

Hill and Trist in their Tavistock (UK) Study earlier in 1953, also related worker turnover to morale of workers, and safety performance. They stated that turnover could also be influenced by such factors as:

(a) Poor or hazardous working conditions;
(b) remoteness of the job site;
(c) bad weather, and
(d) better opportunities elsewhere.

They drew the following conclusions:

> "It is essential that the causes of turnover on a job or in a company be considered individually. Different factors could be the causes of high turnover rates on very similar projects. It is management's role to identify these factors, and then to decide if they can be eliminated or if their impact on turnover can be reduced.
>
> Experience has shown that it is not always possible to reduce turnover as the construction industry is in a constant state of change. A company may find that upon the completion of one project, it has no project to which to transfer the workers. In addition, the construction industry is worst hit by inactivity during an economic recession as it is used to regulate the economy by governments, particularly in the United Kingdom".
>
> (Hill and Trist, Tavistock, 1953)

Andriessen's (1978) study on "Safe Behaviour and Safety Motivation", also covered the role and perceptions of the supervisor on safety performance. Andriessen's study arrived at the following outcome:

(a) Management has the highest influence on the degree of safety of the work behaviour, the group somewhat less.

Of least importance are the personality factors (at least as far as they were studied in the research).

(b) Workers will work more safely with a supervisor who is seen as someone who respects his workers and their contribution, and who is stimulated by a distinct company policy on safety. Because they see that their supervisor regards safety equally important as production, they can also expect that he will react positively when they work safely.

(c) When the attitude and leadership style of the supervisor is excluded, it still holds that one will work safer if one sees that safety has definitely a place in the policy of higher level management. The results of this study support those in a company who advocate safety, in two ways.

  (i) There is an indirect relationship: higher management policy influences that of the direct supervisor, and therefore the motivation of workers.

  (ii) There is a direct relationship: even if the supervisor is not interested in safety, workers will work more safely when higher management stresses safety in its policy. This means also that although the direct supervisor may show positive interest in safety, workers will still work less safely if they realise that higher level management has little interest in safety.

(d) Other aspects of leadership such as a strong emphasis on rules or on high production are not as important as the degree to which the leader respects his personal problems. In other words: working unsafely is not related to the fact that the supervisor emphasises rules or higher performance but, to the fact that he respects his personnel (which is expressed among other things in a certain indifference to safety on his part).

(e) A positive attitude on the part of the supervisor has other positive results, namely, that his personnel are much more convinced that working safely does indeed help to reduce the number of accidents. Probably, we must assume that a supervisor who is positive about safety will also give more information and advice on safety, so that his personnel can see clearly that working safely helps, with the result that they do work more safely. It is essential for employees to realise that working safely really does help to reduce the number of accidents, and it is especially the safety promoting supervisor who can contribute to this conviction.

(f) Groups that are well co-ordinated in their work and in which there are few misunderstandings, work more safely. This is the case because such a group atmosphere promotes the development of a positive safety norm so that members are supported in their working safely by the approval of their partners and other colleagues.

(g) Besides the above-mentioned factors, there are a number of situational characteristics which are important (although it is not always clear why): these are:

(i) size of company;
(ii) working on the basis of piece rate;
(iii) size of the project concerned, and
(iv) floor level (height at which work was being done at the time of the study) etc. (Anddriessen (1978) pub. Journal of Occupational Accidents, pp363-376).

Finally, a report by the HSE (1976), declared that "the most readily identifiable factor in the provision of high safety standards at the workplace is the quality of management". Based on work carried out by the HSE's Accident Prevention Advisory Unit, the report concluded unequivocally that "low levels of health and safety performance in Britain are a function of inefficient management". It stated that any simple measurement of safety performance in terms of accident frequency rate or accident incidence rate is not a reliable guide. The report found no correlation between accident rates and work conditions, the injury potential or the severity of injuries that occur. But it found that factories with a high accident rate, often have parallel problems of high absenteeism, and high labour turnover (same findings as Hill and Trist, 1953; Hill and Hill, 1970; Hinze, 1978).

APAU's studies which were aimed at discovering how low accident incidence rates are achieved, emerge with several characteristics including:

(i) Good housekeeping;
(ii) Compliance with the law (Act);
(iii) lower-than-average absence after minor injury;
(iv) no marked control of the incidence of minor injuries; and
(v) high standards or recruitment.

The report found geographical difference in high accident rates recorded in certain UK regions, and attributed such differences to the following factors:

(i) work methods;
(ii) incidence of machinery accidents;
(iii) relative incidence of serious and fatal injuries;
(iv) structural features of the premises (sites);
(v) training;
(vi) employee selection;
(vii) work group sizes, and supervision levels;
(viii) standards of medical facilities; and
(ix) geographical difference in social attitudes to injuries.

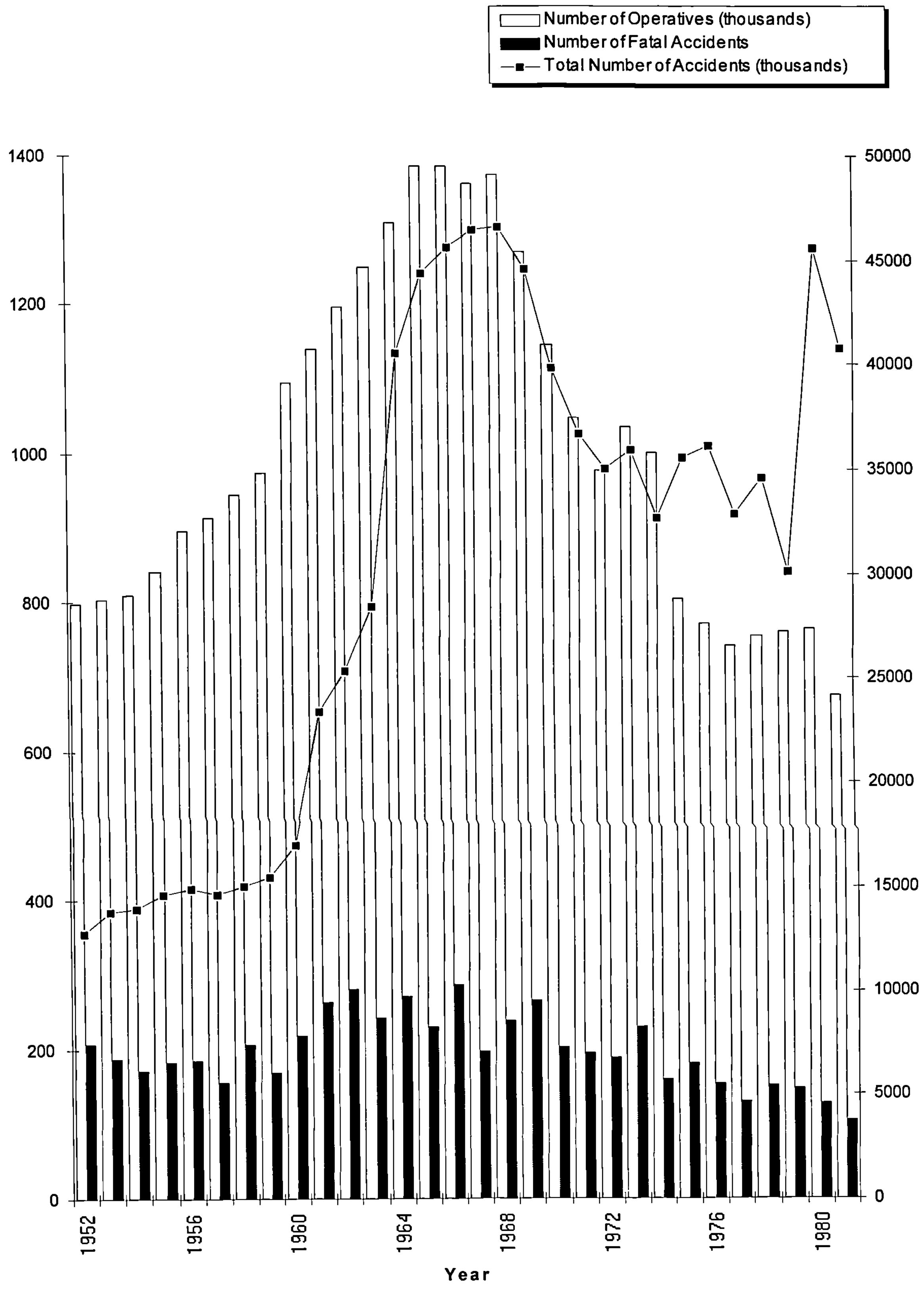
In the United Kingdom as a whole, some twenty percent (20%) of all serious accidents, and forty percent (40%) of all fatalities at work are directly related to construction practices. Fig 2.7 below illustrates the distribution of accidents since 1952 up to and inclusive of 1986. Figures of accidents released by the HSE in 1983 showed that deaths in manufacturing stood at 121, a drop of 11 over the previous year. The same figure for construction showed a rise of 17 to the staggering total of 148. This rise was despite the launch of 'Site Safe '83'. (HSE Reports, 1950-1987). Commenting on the figure, the 'New Civil Engineer' of 16th May, 1985 (p.20) declared:

> "construction finds itself in a period of recession with fewer workers in full-time employment than at any time since the introduction of the Health and Safety at Work Act, eleven years ago. Yet it is suffering the highest incidence rate of fatal and major injury of any section of industry".

The Report concludes:

> " ... but no matter how carefully sites are set up and maintained, it is the attitude of the operatives which finally prevents accidents. Accidents are caused by the same situations repeatedly, and it is only through education that better working practices will be encouraged".

FIGURE 2.7 ACCIDENT TRENDS IN THE UK CONSTRUCTION INDUSTRY



2.9 SUMMARY AND CONCLUSION OF LITERATURE REVIEW

The contribution which literature reviews make to any research, irrespective of subject matter cannot be emphasised enough; therefore this study into 'Safety Attitudes and Safety Performance in the UK Construction Industry' is no exception. The review of available literature has revealed shortcomings in the body of knowledge on the subject matter in the United Kingdom. Although recent developments in academia within the UK have since led to an increase of interest in the subject area, this interest fails to measure up to the published matter in the United States of America. There seems to exist a larger body of knowledge on the subject in the USA compared to the United Kingdom, as revealed by the review. Although a large volume of literature was unearthed during the study, nevertheless, the author declares that the works examined here constitute only a small percentage of knowledge which exists, concerning construction worker and management safety attitudes and safety performance.

Many of the published materials on the subject of safety in the United Kingdom had been mainly concerned with the 'mechanistic' aspects of safety, that is to say, they still do dwell on areas of accident prevention concentrating on guards, machines, tools, and methods, as well as accident statistics, rather than upon the human behaviour elements of the construction industry. However, these published matters remained conceptually, and theoretically lacking in great depth as far as specific attitude studies are concerned. Notwithstanding this short-coming in the UK research field, the review has produced, with some consistency, a body of existing knowledge on worker-management behaviour in the safety aspects of construction.

The review has revealed that apart from the structure and characteristics inherent in construction, certain attitudes prevailed in the workforce, and management which influenced safety behaviour.

Such factors of influence revealed so far entail the following:

(a) The influence of organisational behaviour on worker attitudes to safety performance.
(b) The inherent reluctance to wear safety protective equipment and do things.
(c) The relationships between worker turnover and safety.
(d) The relationships of worker/management involvement in safety policy and safer working practices.
(e) The relationships between 'supervisor attitudes' and the safety performance of 'new recruits/workers'.
(f) The relationships between top management commitment to safety and its influence upon worker attitudes to safety, productivity drive, job pressure, and safety performance.
(g) The effects of the 'macho' image of the worker, and the 'peer-group' character/behaviour upon safety attitudes and safety performance.

All these findings have emerged as an established body of knowledge through research using various research tools in psychology and other social science research methods. The review gives a clear indication that no systematic studies and comparison of safety attitudes and performance can produce a single acceptable research theory in the subject. All that this research aims to do as a result is to complement existing theories and knowledge, and not to develop new research trends. Any findings which result therefore from the study, whether they confirm or reject the set hypothesis would be considered as a fulfilment of the research objectives, as explained in chapters one and three of the text.

2.10 ADDITIONAL LITERATURE

Developments in this field of research have been monitored closely throughout the period of this research. The aim being to update literature which contributes knowledge to the work done in this subject area, and to identify other ongoing research in this field, with particular reference to the United Kingdom. One such work is that currently undertaken at the Department of Building Engineering and School of Management, University of Science and Technology - U.M.I.S.T.

U.M.I.S.T have recently published two papers, and the papers are briefly reviewed below to highlight new approaches, and to acknowledge the importance of continuing research in the subject area.

2.10.1 A BEHAVIOURAL APPROACH TO IMPROVING SAFETY ON CONSTRUCTION SITES

This paper builds upon previous work in the area of behavioural or psychological approaches to solving safety problems in industries. However, this research attempts to develop a reliable safety performance measure, within the evaluation of the effectiveness of the behavioural analytic approach.

To achieve this initial objective, a detailed classification of the most frequent causes of accidents from a wide range of construction safety literature was developed, and used to develop a questionnaire. Arising from this questionnaire, site personnel were asked to rank the frequency of occurrence of each unsafe behaviour/situation, the likelihood of an accident occurring as a result of this and the likely severity of injury if an accident occurred. The authors combined these ratings to produce a measure of perceived risk.

The paper describes the categories of activities sampled for study, and control system adopted, and went on to detail monitoring processes and tentative research outcomes.

Phillips *et al*, 1991, suggests that

> "provided management and site personnel are committed to the behavioural approach, their support should lead to improvements in safety performance levels on construction sites".

Furthermore, they indicated that "the nature of managerial support required by this approach is attendance at goal - setting meetings and/or training sessions, and exerting reasonable pressure on everyone to reach the goals set.

The paper concluded:

> "it appears when the safety is used in conjunction with goal-setting and the posting of performance feed-back, safety can be significantly and cheaply improved".
>
> (Phillips *et al*, 1991).

2.10.2 MEASURING CONSTRUCTION SAFETY

This paper gives a background of the research programme started in 1989, at the University of Manchester, Institute of Science and Technology (U.M.I.S.T), sponsored by the Health and Safety Executive (HSE), entitled 'Improving Safety on Construction Sites by Changing Personnel Behaviour'. Its stated objectives were:

(i) develop and test methods of measuring safety performance on construction sites;

(ii) use these methods to evaluate the effectiveness of specific behavioural techniques aimed at changing work behaviour to improve construction safety.

Under the sub-heading: "SAFETY MEASUREMENT", the paper states that "In managing company quality, audits are adopted as a tool for effective management. To manage safety effectively it is necessary to measure safety performance". It went on to describe the main purpose of measuring safety performance, and the current safety performance measuring methods in the United Kingdom which are accident data; and audit data.

Following the above descriptions, and their definitions, the paper detailed principles of safety measure which it listed as:

- Proportional units of measurement;
- Quantifiable measurements;
- Sensitivity;
- Reliability;

- Validity;
- Understandable;

and efficiency, all of which were clearly defined to aid the reader.

A very significant aspect of this paper, is the method selected for direct measurement of specific, readily observable types of deficiency in safety related behaviours or situations, and which it developed into a model for identifying unsafe behaviours or situations, such as:

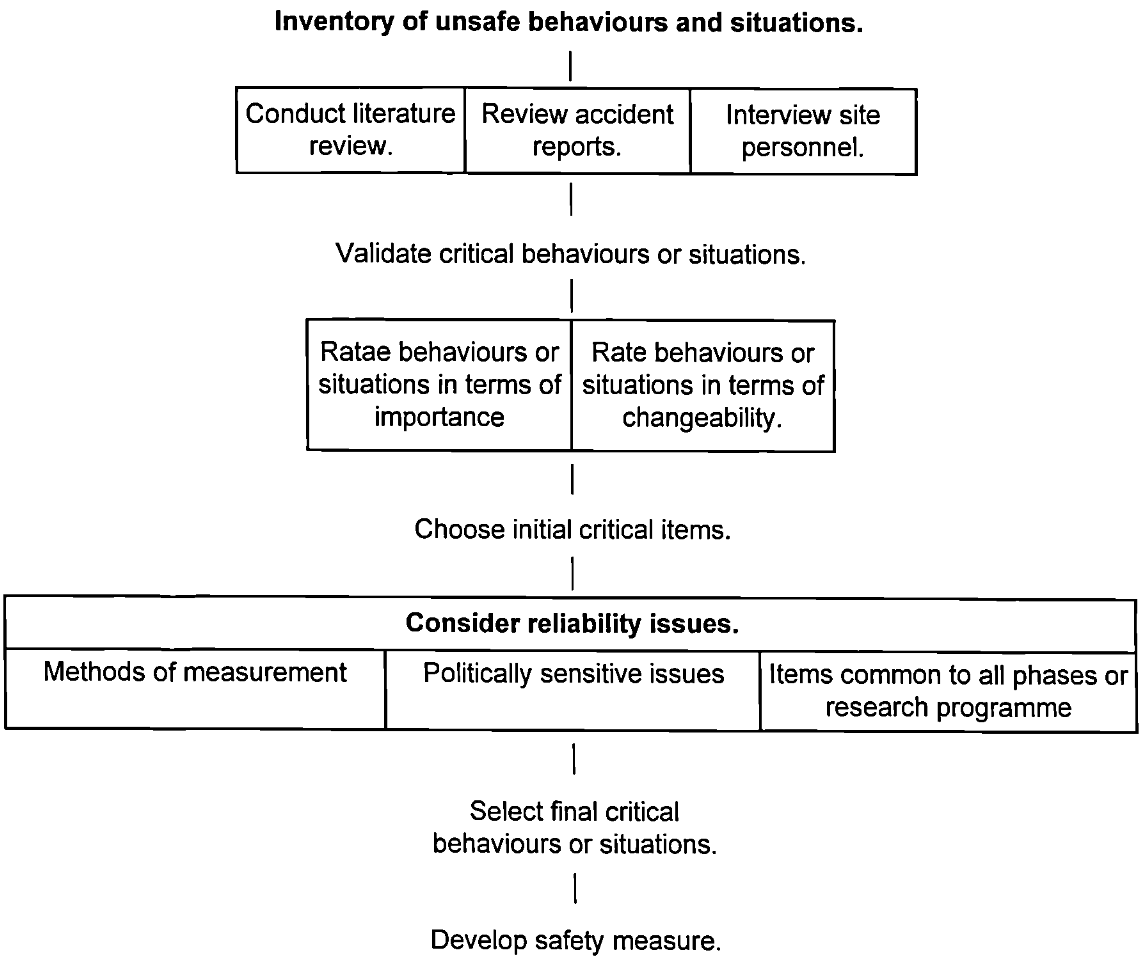


FIGURE 2.8 Model for identifying unsafe behaviours or situations (Phillips, et al, 1993).

From the above, the paper set out to describe systematically, items selected for measurement, and a rating scale used to record the proportion for each unsafe situation or behaviour, and the evaluation of the measure.

It concluded that the most important results of this research suggest that the developed measure is:

- Universally applicable;
- Capable of discriminating between sites;
- Easy to learn;

- Quick to use;
- Reliable, and
- Valid and sensitive.
- R. A. Phillips, A. R. Duff; I. T. Robertson, M. D. Cooper - University of Manchester, Institute of Science and Technology.
- CIB W.65, Trinidad, W. I., Sept, 1993.

CHAPTER THREE

Research Design and Methodology

CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

3.1 THE RESEARCH AIMS AND OBJECTIVES

The main research aims originated from a previous study carried out by the author, in the summer of 1982 entitled: "Employer and Employee Attitudes towards Safety Representatives and Safety Committees in Construction", Sawacha E, 1982 (unpublished), Sawacha E, and Langford D, 1987 (published).

The study determined a tenuous connection between safety attitudes and accident occurrence (safety performance) and the aim of this research is to confirm or deny this tenuous correlation.

Secondly, the general objectives of the research are to provide a framework of reference concerning safety behaviour, in terms of 'workers' safety attitudes (or opinions), and safety performance in the construction industry', upon which decisions might be based in relation to some safety management practices and policies associated with the prevention and control of accidents on construction sites in the United Kingdom.

Specific to the above aims, the following constitute the major objectives of the study, as outlined below:

1. To identify the incidence and diversity of the most common accident causes on construction sites;

2. To identify the more common factors associated with safety behaviour in construction workers;

3. To identify where possible, the extent and effects of company safety policy items associated with employee occupation, age, marital status, length of service etc.

4. To investigate generally, safety behaviour characteristics in relation to employee and organisational variables, such as:
    - (a) Historical factors;
    - (b) Economical factors;
    - (c) Psychological factors;
    - (d) Procedural factors;
    - (e) Technical factors;
    - (f) Organisational factors;

(g) Environmental/or External factors, and

(h) Safety performance factors

5. To review the theoretical an practical implications of safety attitudes (opinions), and safety performance and accident control in the light of the research findings.

6. To suggest/recommend safety systems and procedures where possible, towards the prevention and control of some of the safety behaviour identified by the research as having a strong correlation with safety performance; and finally;

7. To make recommendation(s) based on the research outcome, for further research.

3.2 PREVIOUS RESEARCH MODELS

For any major study of this type, it is essential from the outset to set a research framework, upon which a methodology can be established or developed. In order to assist in ensuring the success of the above, it has become customary - and almost imperative - to embark upon a review of previous research work. Such work may be in the subject area of the research, or in related research fields. This Chapter is therefore devoted in the main, to review and discussions of previous research models conducted by others in the fields of accident research, safety and risks management etc.

Additional to the above, the Chapter discussed the chosen model for the study, its framework and methodology, as well as other areas considered as essential to complement the study.

Upon this background, the primary area of interest to this study, is the development and refinement where possible, of construction safety/accident research models, particularly those models which may lead to the formation of a research framework, and which can hence be either adopted or adapted for the definition of safety attitudes (opinions), and safety performance. In this regard, a model is vital for determining the scope (and variables) of the research. It is the source which drives the research, in terms of identifying the relevant variables that need to be considered and controlled in the spheres of data collection and analysis.

Since the 1960s researchers were concentrating and directing their studies towards investigating the organisation and management of safety, particularly the causes of accidents, and accident statistics.

Surry (1969) reviewed 246 publications, and Hale and Hale (1972) reviewed 355 documents. Even allowing for the 57 publications reviewed in both books, as described by Perusse (1980), the figures represent a large volume of documentation on these topics. Since these reviews, interest in the subject area of safety in general, and construction safety in particular, has continue to develop, and even further publications have ensued through the auspices of the National Safety Council (USA), Aston Health and Safety Society (Birmingham, UK) and elsewhere.

Given that such a large body of reference exists, in order to summarise or indeed evaluate what is known to-date about safety, accident and human factors in safety, so as to indicate where knowledge is wanting, existing frameworks and models become an essential source.

In applying models, two strategies may be adopted:

Firstly, new models may be derived from a systematic, and critical literature review.

Secondly, existing models may be scrutinized with a view to improving them, adapting them, or understanding the state of the art to date.

Models however, are usually devised by authors who have carried out major reviews of the relevant literatures, or by researchers who incorporate a major development to a hither-to published model, on the basis of empirical findings. Research work is that of problem definition; therefore, when a problem needs to be defined for further investigation, comparing existing models can be a valuable source.

3.2.1 The Use of Existing Models (Refer: Perusse (1980))

A selection of models have been devised since the early 1960s to synthesize human factors in safety, particularly in relation to accidents, risks and dangers. Such models like those of Suchman (1961), and Wrigglesworth (1972), are relatively simple and limited in terms of scope, as discussed by Surry (1969). Others are more detailed and tend to incorporate some of the simpler models. In order to have a broad overview of some of these models, this chapter will focus upon brief analysis and/or review of the broader, and more detailed models.

Perusse (1980) has suggested that "Models may be seen as representations of complex realities in summarised and simplified form". He asserted that "very often they are devised for specific purposes and therefore, to criticise a model in great detail can be misleading". General criticisms of a number of models, however, can serve to focus attention upon topics worthy of further consideration.

The first model to be considered is that of Surry (1960). Her model was the first major attempt at providing a structure for the evidence which existed at that time.

Two of the other four models discussed in this chapter were elaborations upon which Surry's model was based. Therefore Surry's model is discussed in greater depth than later models. Later models are reviewed mainly in terms of their features which are relative to Surry's model, and the current research topic. Then similarities and differences between them are also reviewed.

3.2.2 Surry's Decision Model Of The Accident Process (see Perusse (1980))

Surry (1969) proposed a multi-stage model as an explanation of the process by which accidents occur. The first stage or cycle of the model, is concerned with an increasing build-up of danger. The second stage is a direct consequence of the first stage, and is initiated when danger has built up to the extent that it is being released. This "decision model of the accidental process", discussed below, is shown in Figure 3.1.

Both stages or cycles of the model are made up of four parallel types of components. The first category of components in each stage is essentially environmental; it concerns the presence of perceptible indications that a dangerous situation is either building up, or is being released. The second pair of components are perceptual, and refer to whether the information about the impending danger being perceived, is perceived by a person involved in the process in the first place. The third type of component refers to cognitive processes. A series of questions are successively asked in each case:

(i) Is the meaning of the perceived information recognised?
(ii) Is the right mode of avoidance known?
(iii) Is a decision made to try and avoid the impending danger?

Surry (1969) labels a fourth and final component type "physiological response". The question which is asked for that component in both stages or cycles is: 'Does the person have the physical capability of avoiding the danger?'

Surry (1969) postulates that, in the first cycle, if all questions are answered positively "the danger will not grow, and no injury can ensue". But if any question is answered negatively, "the danger will become imminent". In the second cycle, assuming that danger has built up, Surry (1960) suggests that a positive answer to all questions will lead to an accident being avoided. But a negative answer to any question "will lead inevitably to injury" or cause damage.

DISCUSSION OF MODELS

3.2.3 Surry's Model (Figure 3.1)

Surry's model shown in Figure 3.1 illustrates the dynamics of an accident occurrence or non-occurrence. It assumes that the mechanisms for an accident to occur is imminent and building up in a given system or environment. However, what the model does not indicate is the source of the danger within the system, and what form or type of danger was present in the system. It would seem that the danger simply emerges from a situation called "Man and Environment" or the interaction of both.

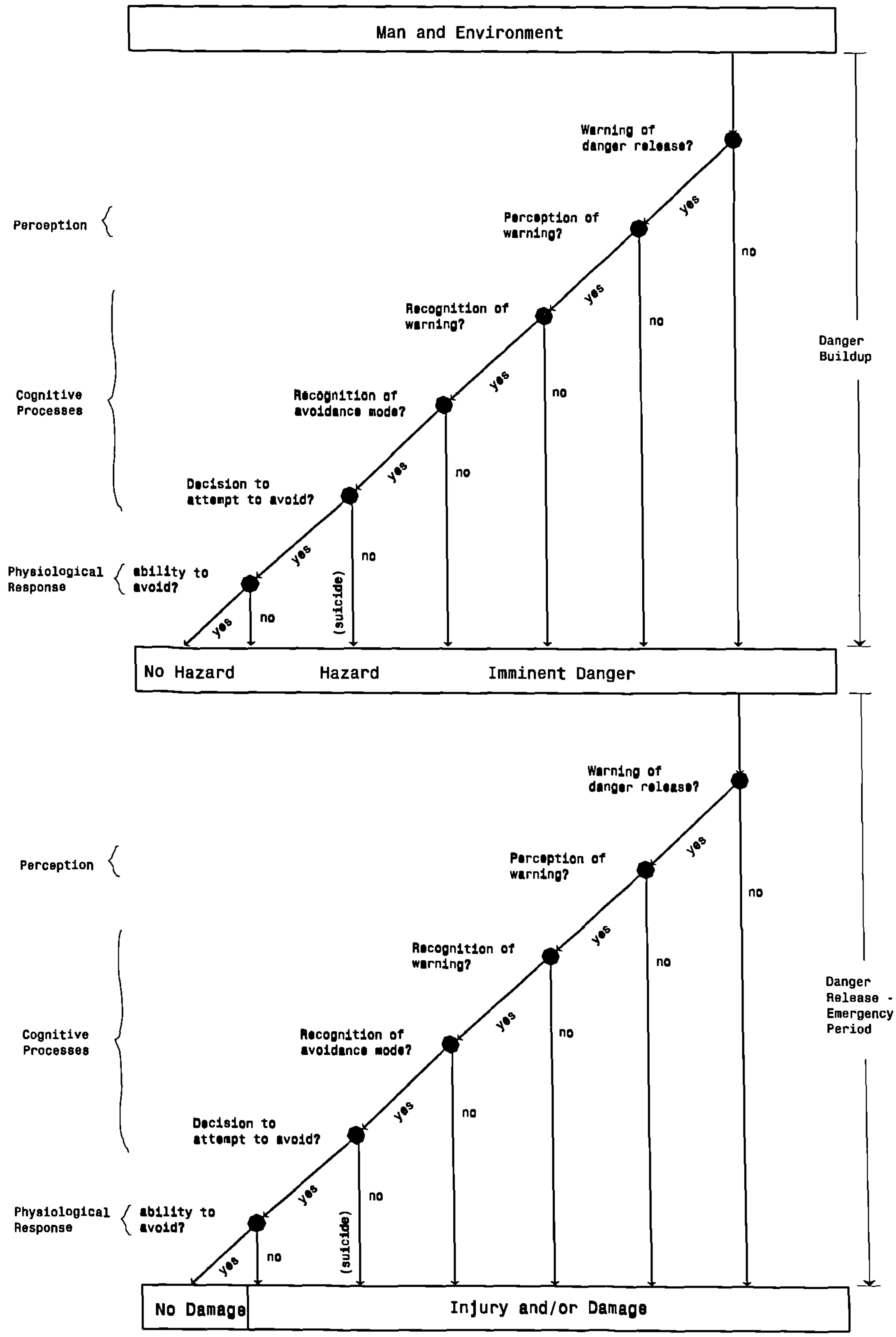


FIGURE 3.1 A DECISION MODEL OF THE ACCIDENT PROCESS (SURRY, 1969)
Source: Perusse M., 1980 (see references)

Also, because the model is not concerned with the origin or the type (nature) of danger, it can only be applied in the description of how an accident occurred once danger was present, and not why an accident occurred. As such, the model could not be used to identify sources of danger, or prescribe what preventative action was to be taken to alleviate them from occurring, or re-occurring. And yet hazard identification and elimination of danger at source is probably one of the most effective prevention strategies in the course of safety control and management.

Another problem with the model is the lack of feed-back loops within the model. Because it does not identify the origin or sources of the danger, and type of danger, it is difficult to infer that control factors exist to counter the imminent danger that is present, bearing in mind that the essence of safety monitoring and control, is the elimination of danger or accident at source, before it has the opportunity to cause damage or not.

Whilst the model satisfies the purpose for which it was devised (ie. to describe the dynamics of accident occurrence), it does not go far enough, to take into account the various factors which impinge upon accident occurrence in any given situation. Also any model relevant to a detailed consideration of accident or safety, must demonstrate a feed-back or loop system. This is because accident occurrence is not a one-off event, but continuous. Incidents must be capable of being monitored, revised and refined, in order that solutions to minimise their occurrence or reduce any damage that such a situation was likely to cause. For this reason alone, this model falls short of the aims, and objectives of the current study. It is therefore suggested that some form of loop might be needed in the model in order to introduce the possibility of some form of appraisal format which is inevitable in any accident situation or model. Such a provision would have led to hazard assessment, which Surry does not mention in her model. The model does not attempt to describe what outcome is likely to result in any case.

The writer suggests that the above issues emanating from the model, must not be taken as criticisms of Surry's ability to devise a model, but should be taken as useful comments aimed at up-dating the model to the present state-of-the-art evaluation of safety. Judging by the literature which Surry reviewed it seems justified to state that her model is an adequate synthesis of these human factors which had been examined up to that time. One can only conclude therefore, that the shortcomings described in this section, can only appear as areas which had been left unevaluated when Surry designed her model.

The rest of this chapter is devoted to discussing some of these models, and other aspects of the research methodology. The models discussed have been chosen, not because of their shortcomings, but as a result of their broad scope, and because they throw new light on to Surry's model.

3.2.4 Model by Andersson *et al* (1978)

One of the criticisms of Surry's model was that, it assumed danger was present from the start, thus ignoring the sources of danger within the system or environment. Andersson et al (1978) argue that this causes problems of "classification of the casual patterns". The model that they propose is an attempt to overcome some of those problems.

Probably the most recognizable feature of this model is the resemblance of its second and third sections to Surry's model, though there are slight differences or variations. In each section, the steps which have been adapted from Surry's model have been given different meanings.

Within each of the comparable sections, Andersson et al (1978) have incorporated two additional steps to Surry's model. These steps ask the questions:

(i) "Can the danger be avoided?" and

(ii) "Is there freedom of choice?"

This introduces a distinction between a danger avoidable per se, and a danger avoidable by a person involved in the process. The corresponding question in Surry's model referred to a person's ability to avoid more than to the avoidability of a danger. These questions remove two of the assumptions which Surry made in her model: firstly, that danger is always avoidable and secondly, that a person faced by danger can always decide whether or not to attempt to avoid it.

The main modification by Andersoon et al (1978) to that of Surry's model (1969) is to include a first section preceding the two sections derived from Surry's model. The first section was devised for the specific purpose of describing the presence of danger in work systems. It examines in some degree of detail, the starting point, labelled "man and environment", in Surry's model. Andersson et al (1978) stated that this section enabled them to shed some light on accidents which could not be analysed by Surry's model. This development of the model therefore seems justified from the theoretical standpoint indicated earlier, as well as from the point of view of practicability for case studies.

The modified model still leaves some of the earlier mentioned shortcomings unclarified. Some of these issues are also mentioned by Andersson et al (1978). Finally, although the new model does describe the presence of situational danger, it can hardly be applied to describe danger which would be attributed to human intervention in the work environment or system. This however, constitutes the essence of the next model to be discussed in this Chapter.

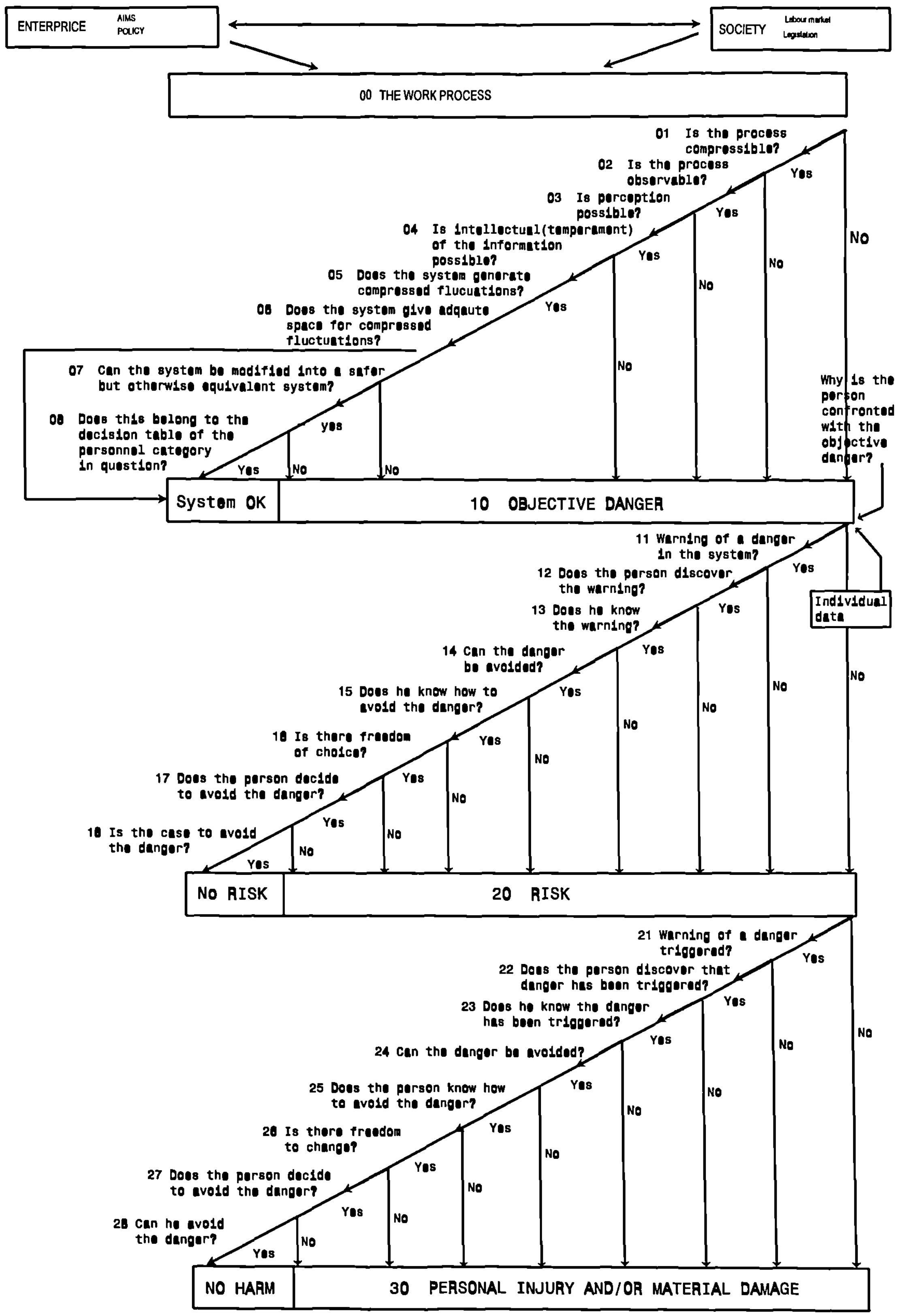


FIGURE 3.2 SURRY'S MODEL AS MODIFIED BY ANDERSSON et al (1978)
Source: Perusse M, 1980 (see references)

3.2.5 Hale and Hale's Model (1970)

Almost at the same time as Surry (1969) proposed her model as discussed above, Hale and Hale (1970) devised a model, the purpose of which was to remedy some shortcomings in their research on accidents. The model they proposed which is discussed here, is shown in Figure 3.3.

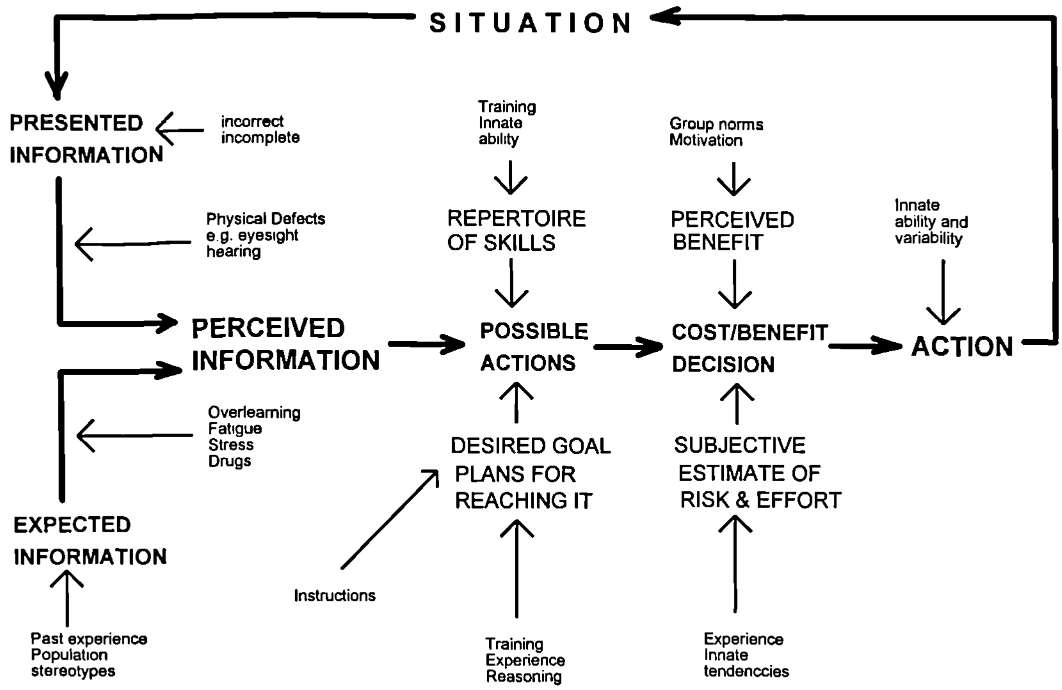


FIGURE 3.3 A Model of Accident Causation (Hale & Hale, 1970)
Source: Hale & Hale (1970) (see references)

This "model of accident causation" has four main steps. Firstly, information is perceived by a person (whether victim of an accident, or bystander (or observer). This information is a function of:

(i) available information;
(ii) information expected by the person; and
(iii) the mechanism influencing both these factors.

Secondly, given the perceived information, a range of possible courses of action are devised in order to cope with this information. The elaboration of the various courses of action is influenced by training, skills, goals etc.

Thirdly, a decision is made about which course of action to adopt. The decision is made on the basis of the person's assessment of the advantages and disadvantages of each type of action. Finally, once a course has been chosen, action is taken.

Whatever action is taken, it influences the prevailing situation. Iinfluence gives rise to modified, different or additional available information with which the person will have to deal. This is the mechanism which is implied by the loop in the top chart of Hale and Hale's (1970) model.

3.2.6 Structure for Empirical Evidence

Hale and Perusse (1978) discussed results of researches undertaken by themselves and their colleagues. In an attempt to provide a theoretical structure for the empirical evidence they reviewed, they proposed the model shown in Figure 3.4 (Hale and Perusse, 1978).

Like Surry's model, this structure assumes the existence of danger from the beginning. Despite the difference in their presentation, the elements of the model are largely inspired by Surry (Hale and Perusse, 1978). The model also assumes that the process is identical at various phases of danger. No feed-back loop is shown either in the model, but it assumed the questions in the model are asked again if danger level is increased. The model is therefore comparable to Hale and Hale's model (1970), when the information which is being processed in the latter is related to danger.

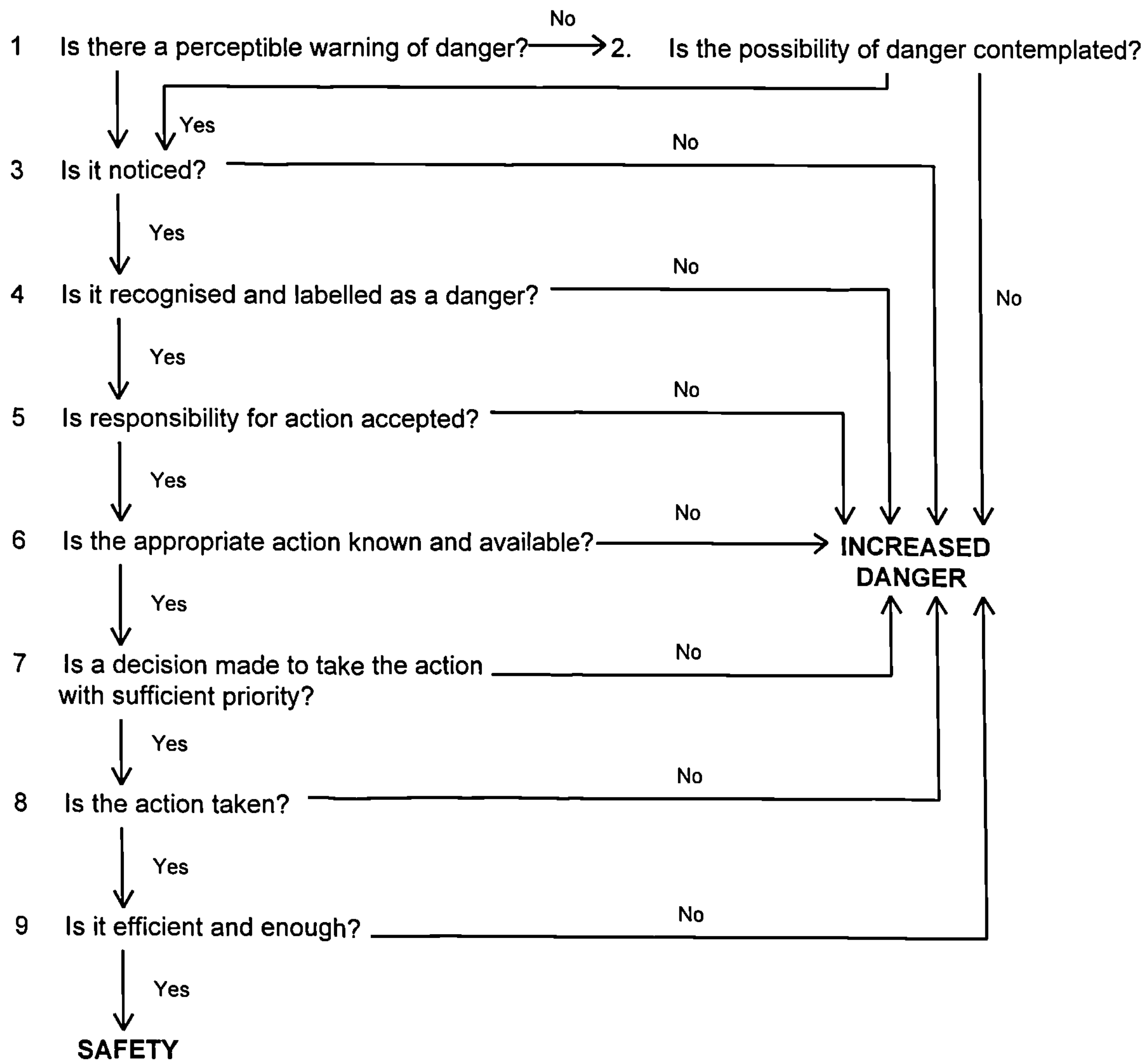


FIGURE 3.4: A DESCRIPTIVE MODEL OF HUMAN BEHAVIOUR IN THE FACE OF DANGER (HALE & PERUSSE, 1978)

Steps 1, 3, 4, 6 and 7 of Hale and Perusse's model (1978) (Fig 3.4) shown above, are comparable to the questions in Surry's model (Surry, 1969) discussed above. But steps 4, 6 and 7, when scrutinized carefully, represent an elaboration of corresponding steps in Surry's model. For example, recognition and labelling of danger appear to be considered as two distinct mechanisms. Whether the appropriate avoidance action is known, and whether that action can be carried out are also portrayed as two separate considerations. These may well be what Surry (1969) sees as two of the steps in her model:

(1) Is avoidance action known? and

(2) Can action be taken?

Finally, step 7 appears to question whether a decision is made, and if it is, whether it receives sufficient priority.

Hale and Perusse's model also includes steps which are not obvious adaptations of earlier models, as discussed above in this chapter. Step 2 is an example of such addition to the existing models. It may be that, even if danger is not perceived, the person confronted with danger (whether actor or victim) checks more thoroughly - possibly with the use of special instruments, or visually - whether danger exists in the system. This behaviour is encompassed by Step 2.

The model is also alerted to the possibility that a person having noticed danger, does nothing about it on the grounds that such action is outside the scope of his responsibilities. Finally, the model points out that there may be circumstances where avoidance action may remove danger only temporarily or partially.

3.2.7 A Model by Saad Darwish, 1987

Darwish (1987) conducted his research at The Polytechnic of Central London to compare fatal accidents in industrial workers (eg. the UK), and in Iraq (Middle East) 'non-industrial workers'. The purpose of the research was to identify factors which have influences in fatal accident occurrence in the two types of societies under study. The model illustrated below in Figure 3.6 shows the main factors studied in the research, and their interactions with the accident situations or environment.

The contrast between the model by Saad, and the others previously reviewed in this chapter is the conspicuous loop which illustrates the relationships or interactions between one factor and the other, and the overall component factors between and within the system. It is seen that the 'environmental factors' play a dominant role as a key factor of influence which impinges upon all the other dependent factors enclosed within the organisational environment. Within the organisational environment, workers' attitudes and their perceptions are seen to have parallel relationships in their interactions with organisational risk management systems, and hence leading to the generation of control and safety performance mechanisms within the partial enclosure of the overall environmental influence. For Saad, whilst the individual attitudes act as a sub-system within the main environmental outer system, which acts as the main trigger of risk factors, human attitudes are dependent upon the outer factors which he describes as 'environmental factors'. Here, in the model, the key environmental factor is acting as an intervening factor to the attitudinal factors, without indicating the relationship of these factors to the process by which accidents or 'risks' occur in the model.

The model however, serves as a highly useful contribution, by listing most relevant factors already identified by most accident researches or investigations.

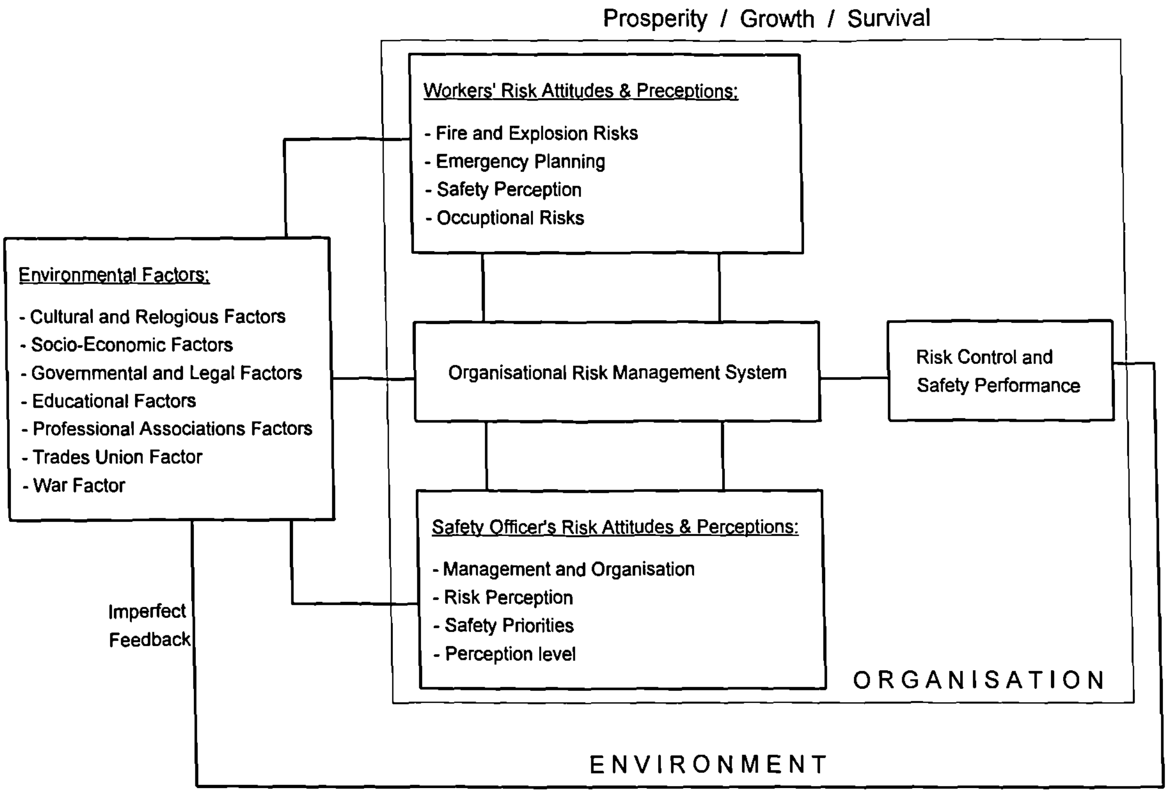


FIGURE 3.5 THEORETICAL FRAMEWORK: THIS MODEL SHOWS THE MAIN FACTORS STUDIED IN THIS RESEARCH AND THEIR INTERACTION
Source: A Model of Safety Risk Behaviour (Darwish S, 1987)

For Surry (1969) the explanation of the process by which accidents occur is highly important, and occupied a more central stage than Saad (1987). On the other hand, Saad (1987) concentrates on the interrelationships which exist between the attitudinal factors and the environmental factors, without indicating their direct relationship or impact upon risk presence in the system. Hale and Perusse (1970) dealt with perceptions of risk, as an indication of danger within the system or environment, and goes on to ask a series of questions which aid decision-making to deal with necessary actions to be taken, in the event of danger or risk being recognised by the person perceiving the risk. Hale and Perusse (1970) identify the presence of risk or danger, but Saad (1987) only assume the inherence of risk within the sub-system. Whilst Hale and Perusse (1970) recognise the hierarchy of dangers, Saad (1987) treats all risks to be the same, and hence equate equal status to them, as far as managing risks/safety environments are concerned.

This model (Saad, 1987) is significant mainly because it emphasises the main thrust of the environmental factors upon other variables within the organisational influences. Darwish (1987) identified once again like others (Hale and Hale, 1970; Perusse, 1980; Leather, 1986 etc.), the environmental influence upon individual attitudes and behaviour, in relation to safety situations (perceived or experienced).

For Darwish (1987), the influence of culture upon attitudes of the person is a significant indicator as to how a person perceives risks and safety in his/her total working environment, and how he/she reacts to safety mechanisms within that environment.

3.2.8 A Model by Leather (1987)

Leather (1983) started the research in 1980 at Lancaster University (UK). The research was initiated and commissioned by the Building Research Establishment, its brief was:

> "to try to describe and understand some of those attitudes prevalent amongst construction workers and management, the aim being, to try subsequently to identify any significant influence points which might be used to effect a greater likelihood of safer working behaviour".

A simple model (shown below as Figure 3.7) was developed from the apparent diversity of problems and 'concerns' revealed by their field survey and then integrated into the model, having at its core the "potential accident subject" (PAS) (see model below) - the PAS is described as

> "the individual who, by his presence on the construction site, is the potential accident victim or is the potential accident contributor and not necessarily the victim. The PAS is the subject of a set of inputs of information or influences (which may be good or which may inculcate unsafe practices), leading in turn to outputs represented by his attitudes and consequent behaviour".

Leather (1983) suggested as shown in the model that

> "the behaviour of the PAS is subject to monitoring, ie., it is observed ("policed") and possibly constrained by custom and practice or the law (legal sanctions). In the event of unsuitable behaviour (or an accident) suggestions (or demands) for

change are returned to the input stage in the form of feedback when inputs may be reinforced or modified, and so the cycle continues" -

as illustrated by the model:

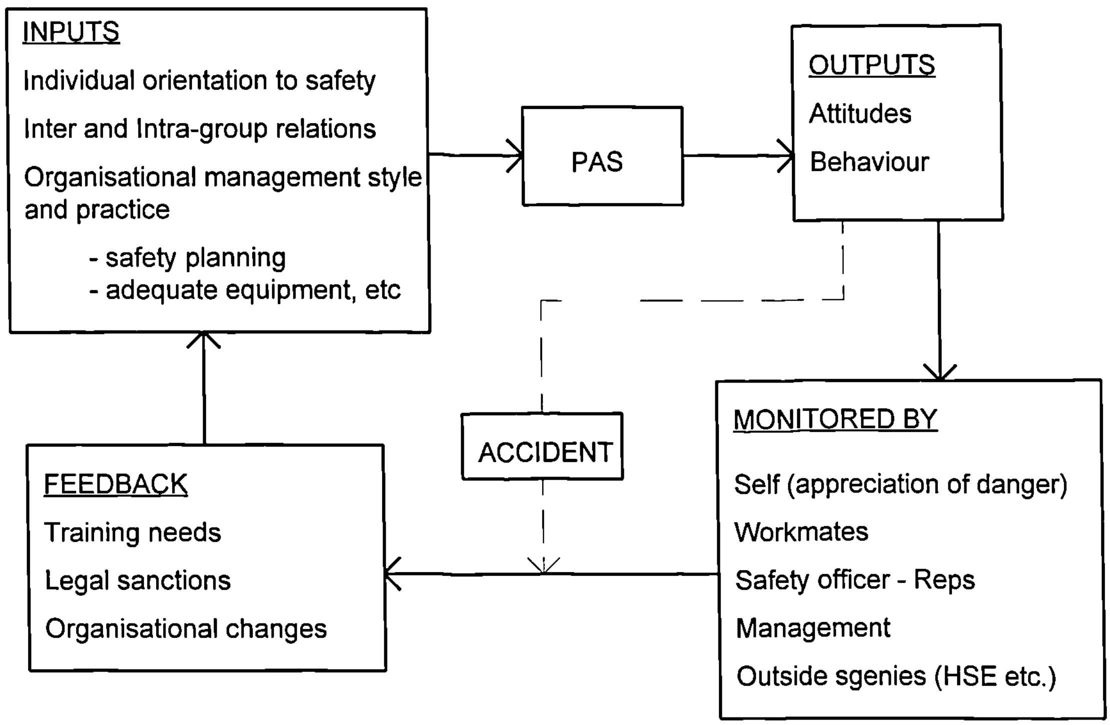


FIGURE 3.6 A MODEL OF ATTITUDE INPUTS AND OUTPUTS OF A 'POTENTIAL ACCIDENT SUBJECT' (Leather P, 1987)

In this model the "inputs" to the model are those environmental and psychological factors listed below.

Environmental (Structural) Factors

a) Site conditions - access to work etc;
b) site tidiness;
c) availability of technical resources;
d) inter and intra-group co-operation;
e) control and supervision of work activities;
f) effectiveness of long-term planning;
g) role and position of safety officer and safety representatives, and
h) pay structures.

Individual Psychological Factors

a) Care and attention on the part of individuals;

b) skill and experience brought to the job;
c) safety training;
d) origins of safety norms;
e) accuracy of subjective risk evaluations;
f) perceived responsibilities;
g) feelings of competent autonomy or fatalism.

Apart from the above influences, Leather suggests in the model that

> "the mechanisms by which change might be effected are threefold: training, propaganda, and what may broadly be termed "example" (the demonstration to the workforce that the organisation is doing all that is technically possible and certainly whatever is legally required)".

This model illustrates once again the interacting factors which culminate in a state of accident situations or occurrences. Whilst the factors are similar to those of Darwish (1987) and the model for this research, the location of the factors in the model, and the emphasis placed upon each factor is varied. Also the model fails to indicate or differentiate between what is 'environmental' and what is 'psychological' within the boundaries of the model itself, and this causes some confusion in its reading. For Darwish (1987) and other models discussed in this chapter, the demarcation between the categories of factors are clearly defined. This is not meant as a criticism of the model in itself, but to highlight a major difference in model designs. A commonality between the models discussed here is that of safety performance measures - taken as "the accident itself, or an accident situation, or near-accident situation". It is agreed from all the reviews that "accident occurrence" is universally taken to be a key variable in the equation of safety performance measurement.

Darwish (1987) and Leather (1983) are the two most recent safety researches which focus upon attitudes as variable which may impinge upon safety occurrence situations. Both models are designed with 'attitudes' as the core of the subject matter under investigation. For Darwish (1987), safety performance results from an interaction which takes place between a selection of environmental factors, organisational influences, and individual attitudes. On the other hand, for Leather, accidents (safety performance) are the culmination of environmental factors and individual attitudes only. For Leather, organisational influences, training and legal sanctions, are feedbacks relevant only as factors needed to effect change in the scheme of things. They are therefore not central to attitudes and the environmental factors - they serve only as post-mortem requirements to solicit change in the future.

Finally, it is essential to note that the location of the factors of influence within the model would also determine their central roles or cores in the research framework. The model by Leather (1983) whilst essential, seems too simplistic.

3.3 THE RESEARCH MODEL

The model presented in this research consists of a number of variables like those of other models reviewed in this Chapter. Where similarities of variables may exist, they do so only because they are common to construction safety attitude surveys in particular, and attitudes to risks in general. Nevertheless, the variables contained in this model are those which emerged from the pilot interviews conducted amongst operatives and management at the outset of the research design. The model indicates only those variables which had to be measured and/or controlled in data collection and analysis. Figure 3.7 shows the inter-relationship between these variables which are to a more or lesser degree postulated in a model similar to those of Darwish (1987) and Leather (1983).

The model displays connecting arrows and a feed-back loop, between safety attitudes and safety performance characteristics; their relationship(s) will only be examined if they are found to correlate. Otherwise, the research model will concentrate on comparing the relationship between the variables and the attitudes factors and any linkage they may have (or not) with the safety performance factors.

3.3.1 Details of the Research Model

The components of the research model are condensed below, and the variables are identified as C1 to C10 (see Research Model below):

Safety Attitude Retainers

The main attitude retainers which constitute the research sample are:

C1 - Operatives, and
C2 - Management : Site management.

In brief, the above may be classified as management and operatives. The categories were chosen for the sample, not because of organisational hierarchy, but mainly because their positions are more directly related to the construction environment where their positions interact with the 'attitudinal generating factors based on organisational policies and practice, and which impinge upon safety performance factors'.

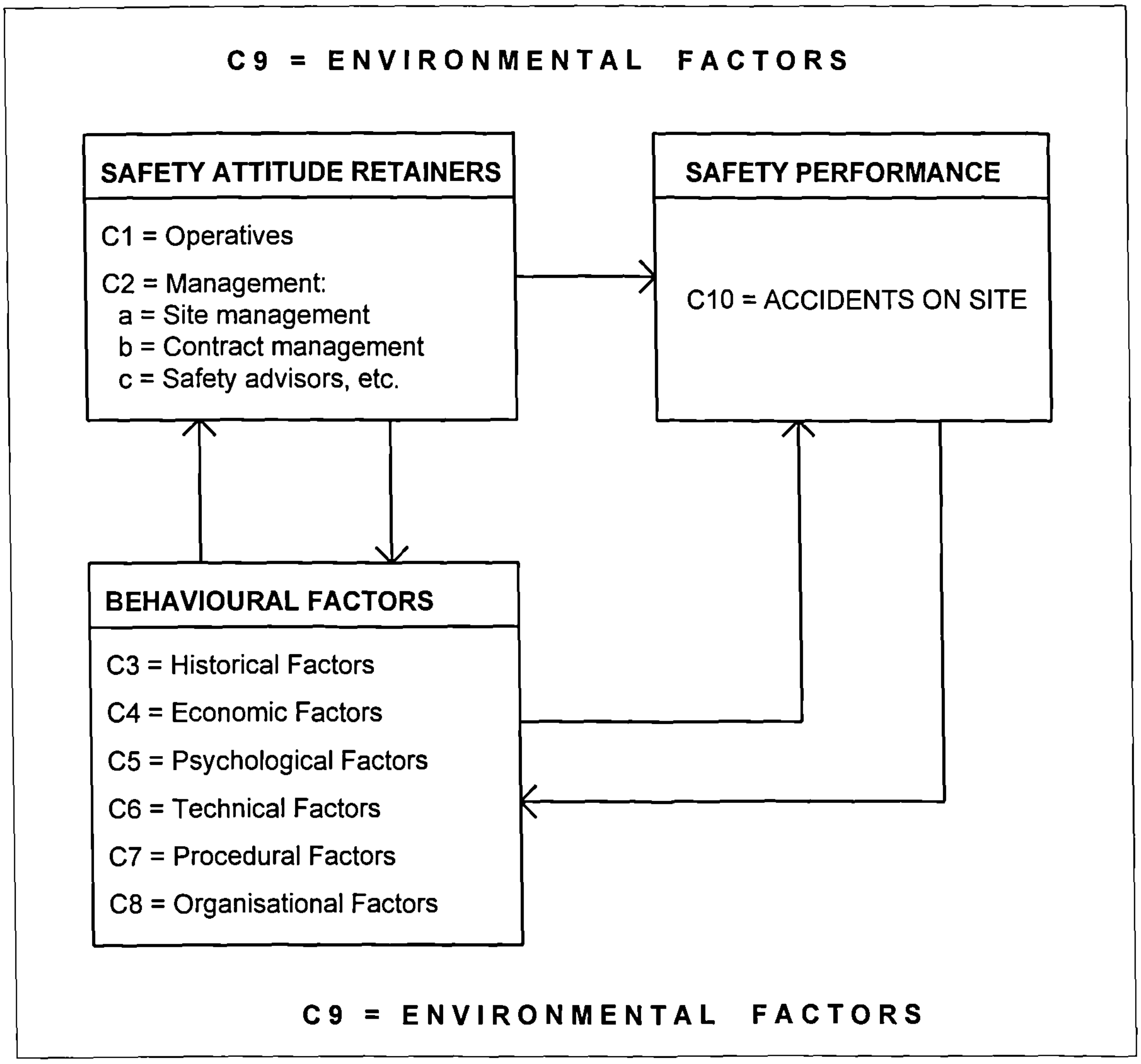


FIGURE 3.7 THE RESEARCH MODEL

Their characteristic roles in the construction industry have an impact on the day-to-day operations which take place on the sites where they interact with each other. Although their individual roles differ greatly and their levels of communication are clearly distinguishable as a result of the nature of the construction industry, nevertheless, their attitudes to safety may not vary. Site managers and operatives, contract managers and safety officers etc. - by virtue of their continuous presence on site, are more likely to suffer accidents, become potential accident victims etc, than non-site-based members, hence their inclusion in the model (Leather, 1987).

Thus it is hypothesized that these variables will influence safety performance, the essence of the research is to identify site-based attitudes which may or may not influence safety performance.

BEHAVIOURAL FACTORS

The factor or characteristics which are considered to generate attitudes of any kind and level on site are as follows:

C3 - Historical Factors;

C4 - Economic Factors;

C5 - Human Psychological Factors;

C6 - Technical Development Factors;

C7 - Procedural Factors;

C8 - Organisational Factors, and ultimately

C9 - Environmental Factors effecting the above.

These variables are considered to influence individual behaviour, as suggested by both management and operatives during the pilot interviews. They all relate to organisational policies, and their implementation, which may vary from company to company, will therefore affect and/or influence, organisational members differently. For example, individual payment systems, overtime, or bonus or profit-sharing, is likely to motivate individuals one way or another, in the operation of their duties within the organisational hierarchy. Provision of protective safety clothing and equipment or non-provision of same, may have some influence on safety performance levels within and between organisations, hence their relevance.

Linkage between the "attitude retainers" and the "attitude generators" and the interaction which takes place may determine the degree of attitude development, and hence influence safety performance.

These variables, and their levels of differentiations between individual categories would be explored and measured where possible during analysis. Any results of such analysis will contribute knowledge to the safety problem in the construction industry.

Safety Performance

For this reason, safety performance is identified as:

C10 - Accident occurrence to person resulting in various degrees of injury.

Historically, the universal measurement of safety performance has been the accident, its victim(s), nature of accident, degree of damage caused, and type etc. However lately, property damage with cost implications were added to the catalogue and then, near-misses, as a source of feed-back to aid future avoidance.

All these factors are currently monitored industry-wide as a true measure of safety performance. For this research, these variables will be considered in the light of data from the questionnaire analysis.

Their individual trends in occurrence will be measured and correlated where possible, with their source of origin - the "attitude retainers".

3.4 THE RESEARCH HYPOTHESIS

The research model (Figure 3.7) generates one central hypothesis, such as:

> "Safety performance is a function of operatives' and management attitudes dependent upon safety behavioural and environmental factors in the construction industry".

For the purpose of comparing safety performance specifically with safety attitudes of operatives and management, the central hypothesis is further broken down into more specific sub-hypotheses, taking into account the behavioural and environmental factors which impinge upon human performance on site.

3.4.1 Sub-Hypothesis

C1 - Operatives Versus Safety Performance.

Safety Performance is a function of operative attitudes influenced by behavioural factors (see above).

3.4.2 Definition and Measurements of the Variables with the Research Model

The variables within the research model has been grouped under four headings. These are:

1. Safety Attitude Retainers

Safety attitude retainers for the purpose of this research, refer to those persons whose attitudes and/or opinions were investigated. By implication, they are those persons whose attitudes/opinions were considered to be most likely to influence or affect safety performance in the British construction industry. These are:

C2 - Management:

i) **Contract Managers:** whose role may involve design, contractual and cost matters etc. He/she may therefore be able to influence safety costs during contractual considerations of the project.

ii) **Safety Advisers/Managers:** the role of the safety adviser or manager, is to ensure that safety audit is maintained throughout the life of the project, including the interface between design and construction. He/she is in fact saddled with the sole responsibility for ensuring Health and Safety on site. His/her role is therefore a major factor in the maintenance of health and safety throughout the construction phases of any project.

iii) **Site Manager/Supervisor:** the site manager, project manager/supervisor is mainly responsible for putting together the project on site. They transfer the design from drawings into reality, and therefore are solely responsible for managing the project and all the resources (including manpower, plant, materials, equipment etc), required to implement the project on-site. His/her role is therefore directly crucial to the general and safety behaviour on site.

C1 - Operatives:

The operative(s) refer to the generality of trade or craft-based personnel who work under the guidance or direction of the site manager and his/her team of trade forepersons/supervisors and safety representatives on site. The operative is considered the most likely person to become an accident statistic on site, because of his/her direct exposure to the construction environment.

The above groups are classified as "Attitude retainers" because they hold opinions/attitudes led by attitude-generating factors, as described below. They are a fixed independent variable.

2. **Behavioural Factors (C3-C8)**

For the purposes of this Study, the term "Attitude Generators" was used to indicate those factors which the research sample identified as most likely to influence the behaviour or attitudes of the persons involved directly or indirectly with a project construction or implementation from design to site assembly. These are the factors which impact upon the people concerned and described above as "attitude retainers" because they hold or exhibit deeply held opinions or beliefs/attitudes most likely to influence their behaviour. These are either independent variables or those which could be described as intervening variables.

C3 - Historical Factors:

These factors consist of personal details such as age and experience, occupation (trade) and training, Trade Union membership etc. Generally identified from the pilot interviews and literature reviews, to be strongly influential in construction worker behaviour and safety performance (accidents). (See Appendix Tables 4.3, 4.4, 4.7, 4.8 and 4.9).

C4 - Economic Factors:

These are such factors as payment systems and reward methods: 'danger money', productivity bonus etc, generally identified from the pilot interviews to be strongly influential to construction worker behaviour and safety performance (accident). (See Appendix Tables 4.16 to 4.21).

C5 - Human Psychological Factors:

These are such factors as worker safety, effect of the 1974 Act, training influence, danger or risk-taking, skills and accidents, supervisor carefulness and worker carelessness etc, identified by the sample to have influence on worker behaviour and safety performance/accidents. Leather (1983) also considered similar variables in his model (See Appendix 4.21 to 4.29).

C6 - Technical Development Factors:

These are for such items as plant/equipment, asbestos etc, known to cause accident damage to persons and property in the construction industry, in the course of their usage. Such items are likely to cause accidents if they are not correctly used, and with care, in accordance with set procedures etc (See Appendix 4.30 to 4.40).

C7 - Procedural Factors:

These are factors which fall into areas considered as 'custom and practice' as far as safety provision is concerned. They include mainly protective clothing and equipment which ought to be used as part of construction safety norms, in order to reduce accident damage or avoidance. Use of safety equipment/clothing and safety instruction is considered as good safety procedure likely to prevent or reduce accident impact on construction workers. (See Appendix 4.41 to 4.47).

C8 - Organisational Factors:

Organisational factors were considered by the sample as such items as: group interactions/inter-relationships, trade union involvement, safety policy and safety propaganda etc. Dawish (1987) labelled them as 'organisational and management risk systems', whereas Leather (1983) considered them as 'organisational changes within a feed-back loop' (See Appendix 4.48 to 4.56).

3. Environmental Factors (C9)

These are the factors which directly concern the site conditions in which the construction workers play their respective roles. It also concerns the inter-relationships between the construction groups, such as inter and intra-group co-operation, control and supervision of work activities, site tidiness, influence of site planning and worker safety observance. Various writers have identified that 'environmental influences' are predominantly crucial as major contributory factors to accidents on site - Tarrants (1976), Leather (1983), Darwish (1987) (See Appendix 4.57 - 4.64).

4. Safety Performance (C10)

Safety performance is defined to mean: accident statistics in accordance with the 1974 Act, and as categorised by the Health and Safety Executive/Inspectorate of Great Britain. These include:

i) **Accident Records/Statistics:** these are records of reportable Accident statistics kept by individual companies and the HSE, as required by statute (See Appendix Table 4.15(b).

3.5 THE RESEARCH FRAMEWORK

The research has evolved from an up-date of previous work (Sawacha, 1982), and through an extensive literature review. This sets the basis for the research objectives, which were then formulated in relation to the principal factors found in the pilot to be associated with safety attitudes and safety performance. The research design developed along the FIGURE 3.8:

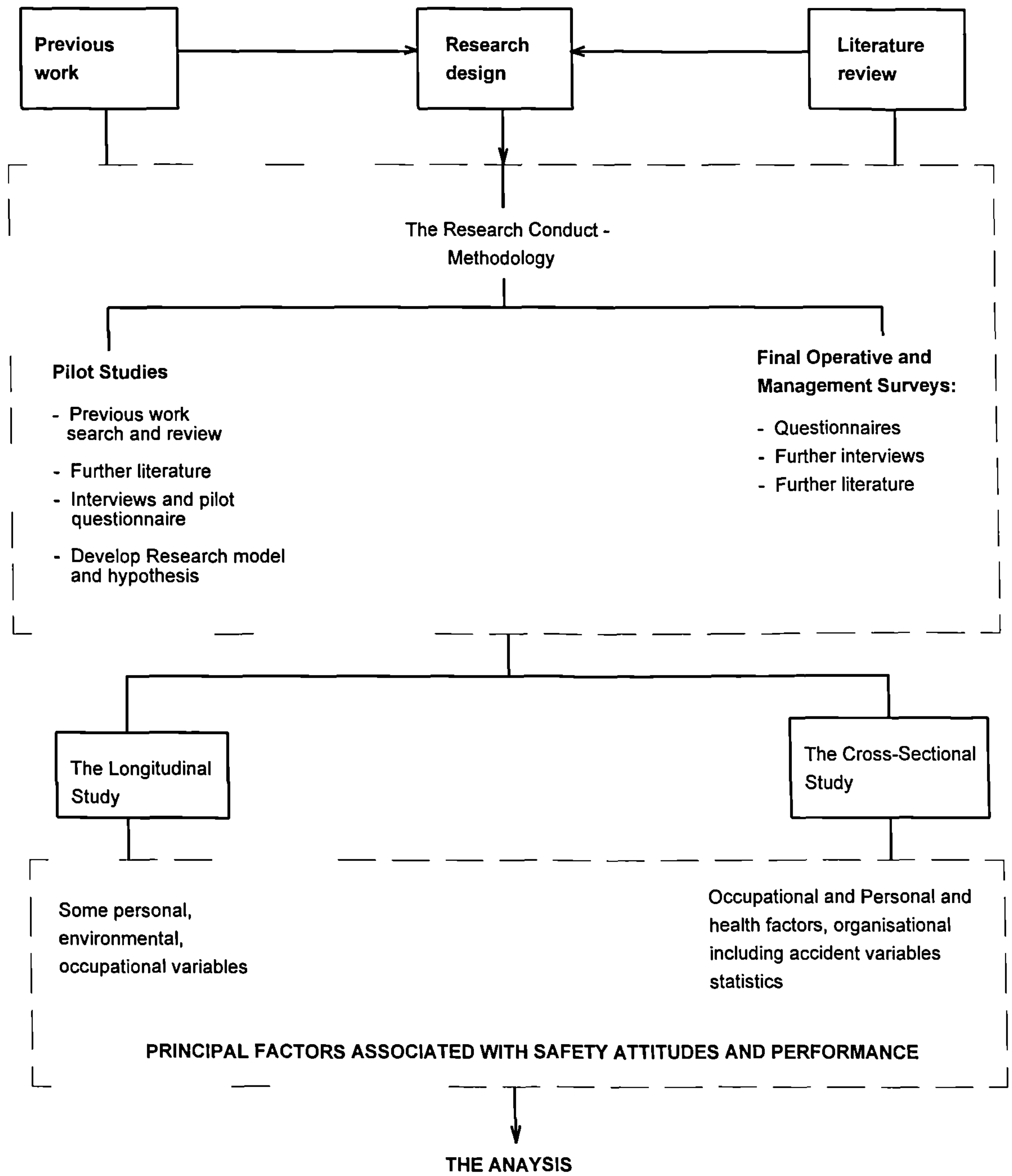


FIGURE 3.8 THE RESEARCH DESIGN

3.6 THE RESEARCH METHODOLOGY

The research methodology was fairly conventional. Conventional because it had followed established research processes and conventions previously adopted by other researchers. For example, Hale and Hale (1970), Vant J, (1986), Darwish S, (1987). These processes and conventions included a combination of the following:

i) The use of the writer's previous unpublished work in the subject area, as background for the study (Perusse, 1980), Vant J, (1986). For the study, Sawacha (1982), had determined a tenuous relationship between safety attitudes and safety performance, in the form of accident occurrence (publ. Sawacha E and Langford D, (1986));

ii) collection of data regarding safety attitudes/(opinions), and safety performance, through the use of purposely designed questionnaires and structured interviews;

iii) a review of major global research studies and published papers on the problems of safety attitudes, safety performance, and the accident phenomenon;

iv) a survey of current construction workers by questionnaire, considered relevant to safety studies;

   a) Operatives - craftsmen/skilled men and unskilled labourers;
   b) site management;
   c) contract/project management, and
   d) safety management.

v) the collection and analysis of data concerning:

   a) Historical factors (C3);
   b) Economic factors (C4);
   c) Psychological factors (C5);
   d) Procedural factors (C7);
   e) Technical factors (C6);
   f) Organisational and managerial factors (C8);
   g) Environmental/external factors (C9);
   h) Safety performance factors (4.15(b))

3.7 THE LONGITUDINAL STUDY (ie. over a period of time)

This was carried out with three national building and civil engineering companies, on three fairly medium and large construction projects in the London, Maidenhead and Uxbridge areas of Southern England. The projects concerned the construction of a new Police headquarters, two office/commercial buildings. Steelframe, concrete and traditional brickwork, and large glass-panelled cladding were used for the major part of the construction; the contracts were valued from £5 million, £10.5 million to £15 million respectively.

The studies investigated general accident levels on the sites, types of accidents which were common to the experience of the subjects, and general safety factors, over a period of six months, amongst a population of directly employed operatives, site managers, contract/project managers and safety managers/advisers.

Data collected over these periods were in the form of unstructured interviews recorded on a mini-tape recorder in open view of those concerned, and later in the form of semi-structured questionnaires designed from data obtained from the preliminary interviews, and validated by the respondents throughout. These interviews and questionnaire completion took place within the construction site environment, ie, site accommodation, and without external influences, with the exception of the occasional telephone conversation. The environment was reasonably controlled, in that people were discouraged from wandering in and out of the designated area of the research exercise. Access to each individual on site was necessary in order to clarify occasional doubtful data, thereby avoiding a revisit just for that purpose. Nominated groups of the contractor's site staff assisted throughout the arduous task of the preliminary data collection, but sub-contractor's members on all the sites refused to co-operate.

All information gathered at this stage of the study culminated in the design of the final data collection processes, and were subsequently transferred onto standard data bank in Brunel University Computer Centre ready for analysis, using mini-tab statistical packages, and SPSS multi-variate analysis package.

A summary of the population studied for the research is to be found in Table 1, under the heading of 'The Research Population Studied', as described below.

3.8 <u>THE CROSS-SECTIONAL STUDY (ie. over a longer period of time)</u>

This was carried out in all twenty five construction companies of mixed sizes, over a continuous study period spread over two years.

Originally, the writer had planned to include only those persons or groups, and companies covered in the longitudinal study, but this idea was rejected, as the constant mobility of workers between sites and companies was thought to have a restrictive effect upon the database, scope and size. As a significant database was necessary for a representative sample, and validity of any results achieved, it was decided to depend upon the population of all respondents to the questionnaire survey.

During the first year of the Study, safety attitudes and safety performance was examined in connection with aspects of site conditions (environmental factors), historical factors, procedural factors and economical factors likely to influence safety behaviour and accident occurrence on sites. The factors were those originally identified through literature search, and through the longitudinal study. Subsequently, further literature search, interviews etc, had revealed that other factors were equally significant to the study, and these included: economic factors, psychological factors etc (refer Research Model), Fig 3.7 above. The last eighteen months was devoted to the distribution and collection of questionnaires developed from data derived from interviews, and draft questionnaires during the preliminary study.

Transcript of interviews recorded with operatives, and management groups, was discussed with operative and manager samples on site, as well as at head offices, with safety advisers etc, to ensure that the transcripts were representative of the views and opinions given at the interviews. Most groups were positively inclined towards their views being truly reflected. The revised views/opinions of those who felt their views were not truly reflected in the original transcripts, were then taken into account in revalidation before the collection of final data.

The companies involved were mainly concerned with the construction of new industrial, commercial, public and heavy civil engineering projects; residential buildings only constituted a small percentage of their company workloads. Some employed in excess of five hundred operatives, and others in the sample employed below one hundred operatives. The company head offices, included 'building and civil engineering', and design sections; safety organisations, plant and joinery departments etc, and were located as diverse as Maidenhead, and London; the Midlands, South Yorkshire, Scotland and South Wales.

Safety behaviour was recorded for each individual, using the questionnaire returns as a basis for the examination of individual safety behaviours or attitudes/opinions. Aspects of the questionnaires contained questions on safety performance of the individual respondent. Individual response to these questions would form the basis for the statistical calculation o safety performance. It was also considered essential to develop some means of assessing the accuracy and authenticity of all safety performance data. Within this context, an important consideration concerned access in principle to all individual company records, thereby the collection of all personnel, descriptive and causative data by whatever method appropriately applied. In this regard, company annual safety reports covering three to five years span, and structured interview questionnaires were used. Assistance was given in the collection of safety performance data by fourteen safety management officers from fourteen companies, and representing six percent (60%) of the overall company sample in the research.

The population surveyed throughout this period of the study, consisted of 126 operatives, 74 site managers, 55 safety managers/advisers, and 56 contract/project managers. Samples of the questionnaire used are contained in the body of the thesis, and give overall details of data collected for analysis. (Refer: Ch 4; pp144; Section 4.4.1 etc).

The study of personal and organisational variables considered to be of relevance to a study of this nature, ie. safety attitudes and safety performance, was examined during the cross-sectional studies. Statistical analysis using MINITAB computer package incorporated in the mainframe computer of Brunel University Computer Centre was applied throughout this research.

The retrieval of safety attitudes data, and safety performance data was somewhat simplified by the use of Likert's Five-point Scale questionnaires, which was scored by individual respondents, according to how each felt against the ranges of factors addressed by the questionnaires (Refer pp. 144 etc). Personal and organisational information for each employee respondent in the sampled population, and their companies were obtained mainly from the questionnaire surveys, and partly from interviews. It was subsequently sought to explain the trends of safety attitudes and safety performance in terms of possible associations with the various personal and organisational variables examined. Details of the interviews, and results of statistical analysis concerning safety attitudes and safety performance are contained in Chapters four, five and six respectively; and Chapter seven contains the general overall conclusions and discussions of the research findings.

3.9 THE RESEARCH POPULATION STUDIED

1. The core of the population studied consisted of:

   (a) Operatives from twenty five companies;
   (b) Site management from twenty five companies;
   (c) Contract/project management from twenty five companies;
   (d) Safety management from twenty five companies.

This 'working Universe' or 'working population' was chosen after the pilot interviews between the writer and some ten safety practitioners from ten construction companies. Prior to the pilot interviews, a realistic literature review was conducted to gain a world view of the research subject matter. This literature review whilst granting an insight into a general Universe or population from previously conducted empirical and theoretical studies (published and unpublished), has confirmed the validity of working from a 'working population' base, rather than a 'general population' base. The reason for this is that, a working population facilitates the sampling process - being the first step to be taken before the sampling process actually begins to decide who or what you are going to sample. Smith (1975) suggests that

> "the population that you as the researcher are interested in will almost

certainly differ from the very specific population from which you decide to sample".

A working universe or population is therefore, the precisely specified population the researcher is actually going to study (Smith, 1975, Ch 6, 'Sampling : the Search for Typicality', pp 105-114). Smith defined the general universe or population as "the wider population to which the researcher (or other researchers) sees his or her findings as relevant".

(a) **Operatives:** the operative group consisted of most trades and crafts operational in the construction industry, and ranged from general labouring gangs to those with specialised or trained crafts or trade skills. Skilled operatives ranged from bricklayers, scaffolders, roofers, carpenters,, plumbers, electricians etc, to plant operators of fitters, steel-erectors etc. A wide range of skills operational in the constructional industry were represented in the operative sample.

A total of one hundred and twenty six operatives (out of an initial survey population of two hundred) representing 63 percent (63%) were studied. Some through interviews on-site before handing them questionnaires for completion, and the rest through postal questionnaires. A breakdown of the individual crafts or trades categories is contained elsewhere in the body of the thesis (ch 4, pp145a of the thesis).

(b) **Site Management:** on the whole, seventy four site managers/foremen (from an initial survey population of one hundred and four) representing 67 percent (67%) were studied. Twenty of them were interviewed, and all were studied through questionnaires completed either on site, or through postal surveys. Their individual background and characteristics of age, original trades etc, are categorised elsewhere in the body of the thesis (Ch 4, pp181 of the thesis).

(c) **Contract/Project Management:** fifty six contract/project managers (from an initial survey population of one hundred and four), representing 54 percent (54%) were studied for this research.

Ten were site-based at the time of the survey, and were interviewed but all others were studied through postal questionnaires. The experience levels were varied; and their general background and individual characteristics covering age, trade/professional levels are discussed elsewhere in the thesis (Ch 4, pp181 of the thesis).

(d) **Safety Management:** the safety management group consisted of safety managers and safety officers who were site-based; and safety advisers and two safety directors based at either regional offices or head offices of the companies surveyed.

Fifty five safety managers/advisers etc (out of an initial survey population of eighty six) representing 56 percent (56%) were studied.

Ten were interviewed, but all fifty five had responded to postal questionnaires. Their levels of experience, age and qualifications, and professional membership details etc, are covered elsewhere in the thesis (Ch 4, pp145a of the thesis).

Additional to the above, twenty three specially designed structured interview questionnaires were posted to twenty three companies, out of the twenty five companies in the sample. Fourteen questionnaires were returned fully completed, and representing 60 percent (60%) of the sample.

A SUMMARY OF THE SURVEY POPULATION

On the whole, the population studied in this research consists of:

(a) 126 operatives, and

(b) 185 managers of different specialisms, forming a cumulative total of some 325 respondents.

TABLE 3.1 SURVEY POPULATION SAMPLE

TABLE OF SURVEY POPULATION SAMPLE			
SUBJECT STUDIED	**QUESTIONNAIRES SENT**	**RETURNED**	**% AGE RETURN**
Operatives	200	120	63
Site Managers etc	104	74	67
Safety Managers etc	86 **	55	56
Contract/Project Managers	104	56	54
Safety Advisors	23 **	14	60
	517	325	63% *

* *Overall percentage*

** *The 23 safety advisors are within the 86 subjects surveyed in safety managers, but two separate questionnaires*

Note: *All questionnaires returned were usable. Although signatures of respondents were not sought by the writer, a few respondents however identified themselves. There was no significance attached to signed or unsigned returns, as individual identify was of no particular consequence to the results of the survey.*

3.10 ANTICIPATED PRACTICAL CONTRIBUTION

This research study will contribute to existing knowledge of safety management, generally in the UK construction industry. It will attempt to identify some of the weaknesses inherent in current factors utilised in the measurement of safety performance, and safety generally.

The analysis of safety attitudes and safety performance management, and organisation will highlight some of the problems related to safety attitude measures and safety management in the UK construction industry.

Ultimately, future planners, and safety policy-makers, and accident prevention personnel may benefit from the outcome of this study, by way of promoting better safety measures and coherent safety management within the construction enterprise as exists in the United Kingdom.

3.11 DEFINITIONS AND MEASUREMENTS

The Measurement of Safety Attitudes

In discussing the notion of response consistency, a major characteristic that distinguishes 'attitude' or indeed 'safety attitudes' from other concepts, is its evaluative or affective nature. Indeed there is widespread agreement that "affect" is the most essential part of the attitude concept (Fishbein and Ajzen, 1973); (Allport G W, 1935). Most of the commonly accepted attitude-measurement procedures arrive at a single number designed to index this general evaluation or feeling of favourableness or unfavourableness towards the object in question. Consistent with Thurstone's (1931) position, attitude may be conceptualised as the amount of 'affect' for or against some object. Thurstone suggests therefore that "attitude" should be measured by a procedure which locates the subject on a bipolar affection or evaluative dimension vis-a-vis a given object. Fishbein and Ajzen (1973), conclude that:

> "there seems to be widespread agreement that affect is the most essential part of attitude, and that the proposed definition therefore appears to do justice to the concept of attitude (p11-13).

Affect, according to Fishbein et al, refers to a person's feelings towards an evaluation of some object, person, issue or event; and that 'cognition' refers to a person's knowledge, opinions, beliefs and thoughts about the object.

The measurement of attitudes of any form, is always problematic, due to the diverse methods of approaches available, each professing to be the most valid. For this study, an 'item analysis' approach is adopted. Using a Likert five-points scalling method described below, respondents are forced to discriminate favourably or unfavourably against statements of opinion relative to some chosen items, ordered under different headings as set out within the pre-designed questionnaires which are used for primary data collection for the study. The statements of opinions are based on items selected during the pilot interviews and questionnaires, by the respondents themselves to represent 'attitudinal objects' against which construction workers are supposed to have an attitude in the UK construction industry. An item analysis of the individual 'item-scores' representing the respondent's degree of feelings expressed under the categories of 'strongly agree', 'agree', 'don't know', 'disagree', to 'strongly disagree', would form the safety attitude measurement as far as the Study is concerned. However, the operative data will further be subjected to multivariate analysis to strengthen the initial analysis by isolating key variables, and to partial out the influences of the variables upon one another.

3.11.1 Thurstone Scales

One of the best-known approaches to attitude scaling is Thurstone's method of 'equal-appearing intervals', which attempts to form an interval scale of measurement.

The first step in its procedure is to collect for the item pool a large number of items, consisting of statements on the survey subject (say attitude to management), ranging from one extreme of favourableness to the other. These are reduced, by cutting out obviously ambiguous items, duplicates, and so forth, to somewhere near a hundred, each of which is written on a card. A large group of 'judges' - perhaps fifty or so, are then asked to independently assess the items.

Each judge has to sort the items into a set number of piles according to his or her assessment of their degrees of favourableness on the attitude in question; and he/she is asked to form the piles so that they appear to him/her to be about equally spaced along the attitudinal continuum. The number of piles is often eleven, but seven and nine are also used, and the middle pile is sometimes labelled 'neutral'. Judges whose sortings indicate that they have failed to perform the task adequately - perhaps through a misunderstanding of instructions or just carelessness - can be eliminated. Then, scoring the piles from 1 to 11 (or 7 or 9), for each item is a median value is calculated - the value such that half the remaining judges give the item a lower position and half a higher - and also the interquartile range, which measures the scatter of judgements (the extent of which various judges place the item at different parts of the scale). This list of items is now reduced by:

(a) discarding those with a high scatter, for they are clearly in some sense ambiguous or irrelevant; and

(b) selecting from the remainder some twenty or so which cover the entire range of attitudes (as judged by the medians) and which appear to be about equally spaced (again, as judged by the medians) along the scale. At the final selection stage it may be possible to choose a second set of items in the same way so that the alternate forms method can be used to measure the scale's reliability; or, alternatively, the scale may be formed as two halves so that the split-half method can be used.

The items so selected are then embodied in a questionnaire, in random order, and each respondent is asked to endorse all the items with which he/she agrees. The average (mean or Median) of the median values of all the items endorsed by the respondent forms the respondent's scale score.

Thurstone scales are sometimes termed differential scales, in the sense that, given a sound and reliable scale, the individual will agree only with items around his/her scale position, disagreeing with those more extreme on either side.

Some criticism of Thurstone's Scaling Method:

A frequent criticism of the method (Moser C A/Kalton G, 1985), has been that the characteristics and attitudes of the people who judge the items in the item pool may be different from those of the respondents whose attitudes are to be scaled, and that the former may affect the scale values.

Another criticism is its laboriousness. The judges' task requires careful application and a certain level of skill, and it may not be easy for the researcher to gain the co-operation of a large number of persons able and willing to do the work (particularly on a building site).

This last criticism was strongly considered as the greatest obstacle to the original intentions of the author, and hence Thurstone's scale method was discounted.

3.11.2 Guttman Scales (oppenheim, 1966)

Another technique considered is the Guttman scales (1944) called the 'scalogram analysis'.

The scalogram analysis was designed to test whether a set of beliefs or intentions can be ordered along a single (evaluation) dimension. The items are said to form a Guttman scale, if they can be ordered so that respondents who endorse an item in one position on the scale (eg. an item put in the 4th position) also endorse all items that are lower in order (ie. items in positions 1, 2 and 3). When this condition is met, the result is a set of items that form a uni-dimensional cumulative scale, and the respondent's attitude is indexed by the most extreme item he/she is willing to endorse.

When discussing attitude-scaling of different types, assumption is made that the various attitude statements in the scale all belong to the same dimension. With the Thurstone method, the only evidence comes from the relative agreement of those who judge the scale position of the individual items. In the ordinary Likert method, the correlations between item scores and total scores provide some evidence, but perfect correlations are needed for complete uni-dimensionality. With Guttman scaling, however, the attainment of a high degree of uni-dimensionality is a measure of concern.

The Guttman Scalogram is fundamentally different from the Thurstone and Likert techniques, in that the latter produce a final score of a given magnitude from quite different patterns of responses, so that it is impossible to tell from the score what the individual answers were. With the Guttman technique, the perfect scale implies that a person who answers a given question favourably will have a higher score than a person who answers it unfavourably. Guttman scale is prone to errors, together with the fact that the ordering of the items in it is unknown in practical situations, making the scaling procedures more complicated than the Thurstone and Likert techniques.

Despite its appealing nature, the author found the Guttman scale method to be unsuitable for the type of study undertaken. It was found to be unsuitable particularly due to the longer process it takes from first stage, to final stage of administering to respondents. It was also considered too difficult for operatives to understand. An added difficulty was caused by the strict deterministic nature of the underlying model, namely that a person who responds positively (negatively) to one item must respond positively (negatively) to a series of others. As a result, departures from scale types have to be treated as aberrations or errors. It was hence decided to use a simpler-to-understand and easier-to-administer type of scale.

3.11.3 Osgood Semantic Differential Technique

By far the most important new contribution (other than Thurstone and Likert) techniques to attitude measurement however, was the development of the semantic differential technique by Charles Osgood and his associates (Osgood, Suci, and Tannenbaum, 1957). Designed originally to measure the meaning of concept, Osgood et al recognised that the technique could be used to measure attitudes.

The semantic differential consists of a set of bipolar evaluative adjective scales, such as good-bad, harmful-beneficial, pleasant-unpleasant, positive-negative. Typically, the adjectives in a given pair are placed on opposite ends of seven-place graphic scales, and respondents are asked to evaluate the attitude object by rating it in each scale. For example, attitude towards War might be assessed by means of the following evaluative semantic differential.

WAR

Harmful : ___ : ___ : ___ : ___ : ___ : ___ : ___ :Beneficial
Good : ___ : ___ : ___ : ___ : ___ : ___ : ___ :Bad
Pleasant : ___ : ___ : ___ : ___ : ___ : ___ : ___ :Unpleasant
Awful : ___ : ___ : ___ : ___ : ___ : ___ : ___ :Nice

Responses are scored from - 3 on the negative side of each scale (eg. harmful - bad) to +3 on the positive side (eg. pleasantly-nice), and the sum across all scales is a measure of the respondent's attitude towards war.

Despite the important contributions of both Guttman and Osgood scales, neither technique goes beyond the assessment of evaluation or affect. Indeed, as late as 1967, Triandia pointed out that

> "There is a gap between those who are primarily concerned with the measurement of attitudes and those who have written theoretically about attitudes: the former frequently rest their case after providing us with a single score, whereas the latter make large numbers of theoretical distinctions but do not provide us with precise and standard procedures for measurement".
>
> (Triandia, 1967, p228)

On closer examination, it appears that the multicomponent view of attitude which Guttman and Osgood et al presents, cannot provide an adequate explanation of the low attitude-behaviour relation. Both Thurstone and Likert scales rely on beliefs or intentions (ie. cognition or conation) to infer a person's attitude. This implies that in providing a measure of effect, the standard scaling procedures already taken into account cognitions, conation, or both. Whether measures are based on statements concerning beliefs, feelings, intentions, opinions, or behaviours, the results will be much the same. It follows that separate assessment of all four components is unlikely to lead to improved behavioural prediction.

The semantic differential, like a Likert Scale, is a summated rating scale; however, while with Likert scaling there is a range of statements but typically only one standard form of response (strongly agree; agree etc), with the semantic differential, there is a range of areas of response but only one issue to evaluate.

For this reason, the semantic differential is considered more suitable for market research where only one issue is evaluated. For a safety attitude research like this study, there are several issues to be evaluated in order to cover broadly the range of item subjects formulating safety attitudes in construction, hence the Likert scale has been chosen for the study.

3.11.4 The Chosen Measure

After a detailed consideration of the merits, and demerits, of the above scale measures, it was decided that the "Likert" Scale of attitude measure was more appropriate for this type of study. It was felt that the above-described methods would constrain the author's success in conducting a study of this kind, and that "Likert" scale was easier to follow by respondents who were mainly site-based, and who had considerably less time to spare on business(es) unrelated to their main tasks. Besides, Likert method was considered to have the following advantages such as:

(a) Less costly;
(b) Ease of data collection;
(c) Easy format for analysis of collected data;
(d) Possessed the characteristics of easier, and more structured result presentation, and more importantly,
(e) convenient in terms of the research timescale.

3.11.4.1 The Likert Scale

In designing the questionnaire(s) for collecting primary data for use in this study, initial consideration was given to three main factors:

(a) The best or most convenient way of collecting the primary data, within the research timescale;
(b) the likely most cheap way for collecting the data, and most importantly,
(c) the best way to order the data collected, for ease of measurement or analysis by computer.

The Likert Scale was found to satisfy all three criterion as stated above, and hence it was adopted as a basis for the design of the questionnaires which were used for this study.

Basically, in Likert scaling, the respondent is not asked to decide just whether he/she agrees or disagrees with an item, as in Thurstone scaling, but rather to choose between several response categories, including various strengths of agreement and disagreement. The categories are assigned scores and the respondent's attitude (or opinion) is measured by his total scores, which is the sum of the scores of the categories he has endorsed for each of the items. Reflecting these main characteristics of Likert scaling, these scales are sometimes known as 'summated and summated rating scales'.

Five categories are normally employed for each item (as illustrated by the questionnaire(s) sample contained in the Appendix to this Report), although three and seven have sometimes been utilised. The usual descriptions for the five categories are: 'strongly agree' (or strongly approve), 'agree' (approve), 'don't know' (undecided), 'disagree' (disapprove) and 'strongly disagree' (strongly disapprove). Although more complex scoring has been attempted, assigning scores of 1, 2, 3, 4 and 5 (in ascending order), or 5, 4, 3, 2 and 1 (in a descending order), has generally been found to be adequate. The choice between the two orderings of scores for an individual item depends on whether 'strongly agree' indicates a favourable or unfavourable attitude. Some items on the scale will be expressed positively, so that the answer 'strongly agree' indicates a favourable attitude, and others negatively, 'strongly disagree' then indicating an unfavourable attitude; thus to make the total score meaningful, positive items must be scored in one order and negative ones in the reverse order.

In forming the pool, Shepherd (1966) suggested that three basic considerations should be borne in mind, which are:

(a) Since the aim of an item is to spread the respondents over the response categories, no purpose is served by extreme items to which nearly everyone in the sampled population will respond in the same way;
(b) it has been found that neutral or don't know items do not work well in Likert scales;
(c) it is advisable to have a roughly equal number of positively and negatively worded items in the scale. Variation between positive and negative items (hopefully) forces the respondent to consider each item carefully, rather than to respond automatically (without thought) to them in the same way.

Shepherd (1966) suggested such approaches act to minimise the effects of a response set towards either agreement or disagreement with whatever statement is made. However, as the items comprising a Likert scale are themselves rating scales they can often usefully be analysed individually.

Unlike Thurstone's scaling, once a large item pool has been compiled a questionnaire format, it is administered to a sample of people reasonably representative of those whose attitudes are to be measured. Whilst in Thurstone scaling, the initial judges do not represent the sample whose attitudes the researcher intends to score. In Likert scaling, the sample population are asked in the first instance to respond only to each item by choosing the category representing their own opinion. The item analysis for eliminating poor items involves examining the consistency of their responses to the various items. One way of investigating this internal consistency is to correlate the scores of individuals on each of the items with their total score (or total score less the score on the item involved); items failing to correlate highly with the total score are rejected. Other methods of discrimination of items for rejection in the final questionnaire, are well documented in text books for the subject of psychology/social psychology. As such no detailed description of such methods is discussed in this study.

Likert scales seem to have higher reliability than Thurstone scales of the same length, and also require fewer items to reach a given level of reliability. The main reason given for this key difference is that Likert scales collect more information per item than do Thurstone scales.

When the items have been selected, it only remains, apart from testing reliability and validity, to ask the actual respondents to indicate their attitudes by checking one of the categories of agreement or disagreement for each item on the scales. The total score is then derived as described above, and scores are allocated according to intensity of opinions, and not according to the content of the item.

Moser C A, and Kalton G, (1985) have explained that "A Likert Scale" is clearly not an interval scale, and no conclusions can be drawn about the meaning of distances between scale positions. Fishbein et al on the other hand suggest that:

> "there are doubts as to whether Thurstone scaling, which attempts to attain interval measurement, produces a true internal scale".

They agree that Likert scale appears to be a reasonable ordinal scale, and that, "it is somewhat simpler to construct and it is likely to be more reliable than a Thurstone scale".

The author has adopted the Likert scale mainly for its simplicity, and straightforwardness in its design, and ease of analysis of data resulting from it. More details concerning statistical techniques for data analysis are discussed under the heading: Possible Analytical Approaches (see paragraph 3.4 below).

Though Likert attitude scale is adopted for this study, it is worthy of mention again that, for this study, "attitudes" and "opinions" are taken to be synonymous. The terms 'attitudes' and 'opinions' are hence, interchangeable for the purpose of this study: the questionnaires used for data collection and measurement are therefore viewed as instruments for the collection of attitudinal/opinion data. The results of data analysed for the study, should be viewed as measures of attitudes/opinions of the respondents sample population studied.

3.11.5 Safety Performance Measurement

No industrialised society, or indeed any society today, is without the complex phenomenon of accidents and fatalities, resulting from the effects of human interactions with work and machines within industrial, commercial, social and even home environments. The control of such accident incidences and fatalities has been focused upon the best possible safety performance measures. Nevertheless, most of our present-day safety checks and efforts are based on "after-the-event" appraisals of loss-producing factors that happen to produce an accident of sufficient severity to be included within the limits of our reporting criteria, or to make the front page of the national media or press.

Tarrants (1976) suggested that "present attempts to control accidents and their consequences can best be described as "trial-and-error", chiefly because adequate measures of the effectiveness of this control do not exist in practice". For Tarrants, "control must begin with sound measurement". The degree to which accident control is possible is a function of the adequacy of the measures used to identify the type and magnitude of potential injury-inducing problems existing within the field of concern.

If we follow the standards and criteria set by the Health and Safety Inspectorates throughout the United Kingdom, the criteria for reporting accidents involves more than three days lost time or some permanent injury, first-aid or disablement or death.

Such is the state of play in the U.K. that hardly any system exists for the monitoring of 'non-injury' or 'property damage' accidents or 'near-misses'. Any such system which may exist, result from individual company initiatives or efforts. Even then, such systems or records can best be described as 'scanty', since they are based not on statutory guidelines, but on individual company goals. At present, any records which exists of non-injury related damages to persons and property is therefore voluntarist; statute or regulations do not prevail upon companies to maintain or report such occurrences in the United Kingdom or elsewhere.

In the industrial context, the level of safety achieved is a combined result of philosophical, legal, economic, technological, managerial and motivational factors of influences which exist among others. The measurement of construction safety performance levels, are also subject to these influences, and a critical study of safety performance measurement will have to take them into account. For example, the earliest safety performance measurement may be traced to the emerging industrial safety legislation in the late 19th and early 20th century that required factory inspections, the guarding of dangerous machinery, and the assumption of financial liability by employers (Factories Act, 1937 and National Joint Council, 1948, refers).

Safety measurement generally involves the measurement of safety events (or their consequences) that have been labelled "accidents". There are many conceptions of the term "an accident", and the conception that is selected will, therefore influence the measurement criterion employed. To many, the word "accidents" and "injury" are almost synonymous; nevertheless, those familiar with accident research, proffer a number of definitions/conceptions of the word "accidents". For example, at one extreme, the fatalistic view of accidents ascribes their causes to "forces outside the control of the individual". From this standpoint, there is little to be gained in their control or measurement, as the phrase: "an Act of God" can still be found in legal text books or in literature.

Parallel to the above fatalistic view, is the belief that so-called accidents are random events, again, with little to be gained from their tabulation.

Arbus and Kerrich (1951) defined an accident as

> "a chain of events, each of which, being the result of some non-adjustive act on the part of the individual (variously caused), may or may not result in injury".

Greenwood and Woods (1919), saw accident causation as an invariant human characteristic, summarised under the cloak of "accident-proneness". Hence the measurement is of selected personality characteristic of the individual.

> " -an accident, with or without injury, is in the main a morbid phenomenon resulting from the integration of a dynamic variable constellation of forces, and occurs as a sudden, unplanned and uncontrolled event".
>
> (Schulzinger, 1954)

A concept which has a direct impact on industrial safety measurement, despite the variations in the definition of the consequences of safety mishaps, is "causation". "Causation" has been simply defined by the axiom

> "that every effect has its single cause, and that the aim of accident investigation, and hence its measurement/recording of it, is to locate that 'cause'; the aim of safety measurement is thus the tabulation of the various causes uncovered by investigation".

From the above basis, it seems that the problem is that of finding a criterion of safety effectiveness, and some way of measuring safety performance. Because lost-time accidents or injury-producing/disableness accidents are statistically rare events, and first-aid cases and serious injury frequency rates are subject to large-scale under-reporting, the safety practitioner is faced with only an intuitive notion of the effectiveness of various accident prevention methods.

Recent figures released by the Health and Safety Executive, indicating accidents occurrence across all industries up until April 1988, showed that 175,000 injuries at work were serious enough for the victim to need more than three days off work and 405 cases were fatal accidents. The HSE again emphasized "substantial under-reporting". It says that the true injury statistics were at least fifty percent (50%) higher than tabulated, and that "failure to report is most prevalent among the self-employed". The self-employed accounted for 1,756 cases, with about two thirds coming from the construction industry. Deaths at work have shown a slight downward trend since 1982, but the worrying thing is that of the consistency of the death rate, which has averaged 400 for the last six years. Major accidents by contrast have been increasing from 12,407 as reported in 1982, rising to 13,389 in 1985, and 20,379 in 1987.

Published performance statistics by the HSE also indicated that among employees, the most common accidents remained: falls, slips and trips, followed by handling and lifting or carrying objects. Together, the report (provisional) states that

> "these accidents account for more than half the total (ie. 56 percent). Eighty-eight percent of accidents (classified under minor accidents) resulted in more than three days off work".

These statistics, though interesting to read, fail to tell the complete story. A true reflecting of safety performance measurement must be capable of appraising the internal effectiveness of an accident prevention programme by directly measuring its influence on an acceptable criteria of safety performance as it fluctuates over time.

Whilst accident statistics remain a true 'after-the-event' pointer in safety performance measurement, they indicate only one consequence of worker behaviour within specified industrial work activities. As such they tell us very little about antecedent behaviour, without covering the wider aspect of the total work-environment. In effect, a realistic measure of safety performance must help the safety practitioner to prevent, not just record, accidents. It must cover items such as:

(a) hazard identification;
(b) machine/plant/tool failures;
(c) property and equipment damage;
(d) human error analysis, including failure to us safety protective clothing and equipment;
(e) site condition/work environment etc.

Tarrants (1965) suggests that the purpose for safety performance measurement must include:

(a) help to prevent and report accidents;
(b) report continuously on the change in safety levels within a plant and to evaluate the effects of accident-prevention efforts as rapidly as possible within an organisation.

Such measures he stressed, should be measuring 'lack of safety', instead of 'the presence of safety'. Tarrants stated that a realistic safety performance measurement should be

> "A technique selected for its applicability to a particular situation, the relative cost involved in using it, the criticality of the component or system under study, the desired output, its compatibility with other programmed activities, and its meaningfulness to managers and to those who must use it".

Additional to the above, he suggests "an accident causal factor identification technique is needed which will identify non-injurious accidents as well as those involving injuries" ... "we should be able to identify unsafe conditions or defects in the work environment, which have an accident-producing potential". In accordance with his conception of safety, he defines 'accident' (1965) as

> "As unplanned, not necessarily injurious or damaging event, which interrupts the completion of an activity, and is invariably preceded by an unsafe act and/or an unsafe condition or some combination of unsafe acts and/or unsafe conditions".

Other writers have equally proposed that whilst it has been customary to name a single factor as 'the cause of the accident', even people who recognise that nearly all accidents have more than one factor, may urge us to report only the 'most important' factor is either the easiest factor to discover or the easiest to control (Blumental, quoting Baker (1954).

Grimaldi (1970) argues differently by taking the stance that

> "safety achievement is best not measured simply in terms of the occurrence of unqualified events, with an absolute null point as the performance objective".

He argues that

> "There is a normal predilection, it seems, for taking risks if the possible consequences appear more attractive than the apparent probability and degree of harm that exposure to them may present. ... the ambivalent attraction between safety and risk apparently is a deeply ingrained human bent, which often disables wise decision".

Society, like the individual argues Grimaldi

> "apparently responds to day-to-day perils - in accordance with the dictates of the most influential culture and needs of the moment - by accepting a level of safety that it finds tolerable. Thus a zero accident incidence, although ideally desirable, is not the universal standard for safety effectiveness.

Grimaldi (1970) concludes that the difficulty in setting a universal safety performance measurement is because, safety standards seem to vary from individual to individual, and within the individual according to the several discretionary factors he sees.

According to Grimaldi (1970), there are four judgement factors which, although not usually calculated rigorously, may intuitively govern safety decisions.

(a) The likelihood (probability) of an unwanted consequence occurring;
(b) the maximum degree of harm that could result from the consequence;
(c) the social-sensitivity of the issues associated with the possible consequence (ie. their legality or ethicalness);
(d) the magnitude of the gain expected from the action taken.

He concludes that each factor is related instinctively in some degree when a safety decision is required.

It appears that a performance measurement which uses accidental events in some scalar fashion to quantify safety effectiveness cannot reliably and validly reflect the quality of the safety process.

Drucker (1954) likened the measurement of safety performance to that of managerial work, as illustrated in Figure 3.10 below:

Based on the above theory, Drucker asserts that

> "the industrial hierarchy is an outcome of the need for distributing and channelling the responsibility, authority and accountability for the fulfilment of the corporate objectives".

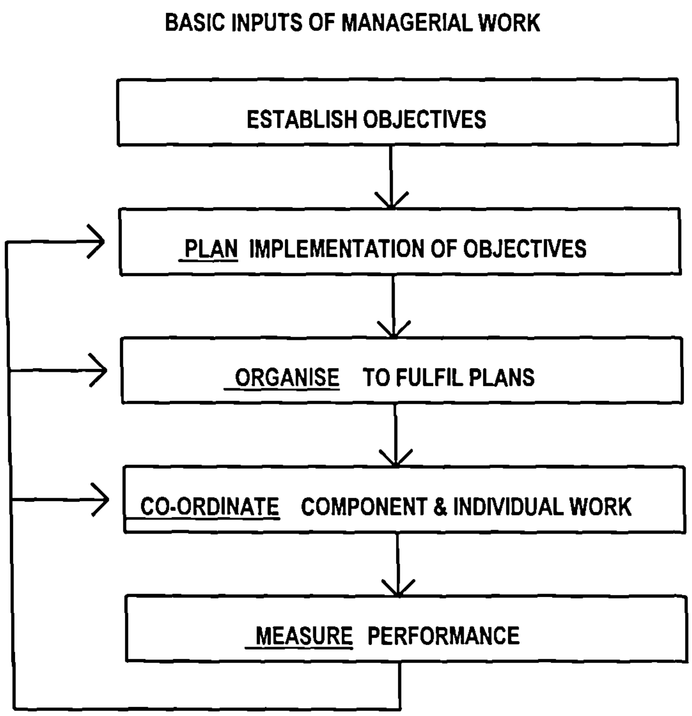


FIGURE 3.9 FLOW DIAGRAM OF MANAGERIAL WORK INPUTS AND MEASUREMENT FEEDBACK

As such

> "safety is no more likely to be accomplished than any of industry's responsibilities, if the hierarchical chain does not activate it as well".

For this reason it appears especially important for the safety performance measurement to be responsive to managerial measurement requirements. This suggests that the measurement technique should assist, in its area of application, the fulfilment of the steps which generally comprise the work of management. Thus in the above diagram of inputs to managerial work, it is seen that the manager plans the accomplishment of his objectives, organise to achieve his plans, co-ordinates the workings of his organisation, and then measures its progress providing thereby a loop which enables optimisation according to the sensitivity, clarity, reliability and validity of the measure's feedback. "This is the means of control" (Drucker, 1954). Drucker declares that "The measurement used determines what one pays attention to". It seems therefore that the measure should deal clearly with what it is that is essential to the performance objectives. However, various studies indicate the universal agreement that measures of safety performance customarily have been "accident-rate" yardsticks, probably on the supposition that numerical differences in accident tabulations, over periods of time, mirror the relative intensity of safety programmes (Hale and Hale, 1970; Tarrants W, 1970; Blumenthal M, 1970; Grimaldi J, 1970). Jacobs (1970) summarises the purposes or objectives of safety performance measurement as follows:

a) Evaluating the relative "levels of safety" of various activities or operations as a basis for:
   - measuring the relative effectiveness of safety management practice;
   - determining the level of remedial effort to be applied;
   - allowing effort between competing (for attention) operations.

b) Evaluating overtime, the degree of progress or regression in the specific hazardous situations, as a basis for:

   - appraising progress in safety management effectiveness;
   - determining changes in the type or level of remedial effort being applied;
   - assessing the cost/effectiveness relationship of alternative counter-measure systems.

Jacobs (1970) conclusion was that

> "the ultimate object of measurement is not "accidents", rather, it is some intrinsic property which might be thought of as "safety expectation", which depending upon the generally strong role of chance, governs the probability of occurrence of any given number and severity of human accidents during some specific future time interval or some particular amount of human exposure".

This property is, of course, not directly measurable, but must be inferred from the measurement of other attributes or events which are observable - including, but not necessarily limited to, current accident rates.

Measurement of safety performance must measure only those attributes which relate to the specific occurrences which it intends to control. A useful and efficient scheme will hence seek to cover only those occurrences which are the subject of particular control interest.

While many authors on safety performance measures may profess different approaches to the problem of human accidents, nevertheless, they are agreed on a single common ground, which is, "that safety performance measures depend on accidents to occur before they can be calculated".

Recognising this common ground, most current approaches to safety performance measurement being used in industry rely on:

a) the use of available historical data; for example, accident data, accident cost, accident frequency rates, severity rates, etc, and secondly;

b) the use of indirect indices based on the occurrence of events which are believed to be related to the causes of accidents, and which are statistically much more frequent in their occurrence.

For this study, a similar criterion was followed. However, the approach and data considered for use in the determination of safety performance measurement was derived from tabulations and calculations deducted from data representing cumulative rating of some chosen items which bear upon accident/damage factors. Such factors were those identified by the research sample and population, and which are contained in the four purposely designed questionnaires for the purpose of this study. These factors or items were those identified in the pilot study, and which were then applied to the questionnaires used in the cross-sectional studies. The questionnaires have been designed in accordance with Likert - five-point scales, and arranged likewise to take account of the most repeated items by the pilot population, as indicative of accident-producing factors. An evaluation of these factors based on the Likert principle of data ordering, forms the basis of the human behaviour and environmental sampling. From this, an analysis of such data determines the level of safety performance measurement in the form of an index or indices. For this study therefore, this comparative index would form the measurement of safety performance of the sample population.

3.12 METHOD OF ANALYSIS TO TEST THE HYPOTHESIS

3.12.1 Previous Research

One of the most noticeable features of the models reviewed above, is that despite specific differences in their general aims, their general methods still show some similarities. For example, in all the models, instruments were devised to identify the meanings which people attached to hazards, or safety behaviours. To a large degree, the instruments specifically measured people's perceptions of hazards, or safety behaviours.

As such, it is not totally unexpected that these models and their instruments of measurements, show similarities. All the instruments reviewed were based on a classification of two broad types of components. Firstly, respondents in the form of questionnaires, or structured interviews. Secondly, they all included a series of scales which respondents used in order to rate the items of hazards or potential safety behaviour. Resulting from the detailed literature reviewed, it was apparent that similar components or instruments would be adequate for this study. The method chosen for analysis is therefore similar to those applied in the models reviewed in this study.

Whilst all the instruments were similar, there were however some important differences between them. Differences between instruments only stemmed from mainly the way in which these were assembled. In the main, Goland, and Burton (1969) used a 'semantic differential test' for which hazards and scales were provided by the researchers; Green and Brown (1976a) used a 'repertory grid' for which the researchers supplied the list of hazards; respondents themselves provided the criteria which they subsequently used to rate the hazards. Champion (1977) also used a form of 'repertory grid' where criteria or scales were elicited during a series of pilot studies, and supplied to the original respondents in order for them to rate the hazards on these scales.

Considering the above, it would have been logical to apply a 'repertory grid' format for this study. But as discussed in 3.6 above, the "Likert Scale" was chosen instead as more suitable instrument of measurement. The reasons for this choice of instrument can be found in Section 3.6.4 above.

Also, Dr Leather (1987) on a study similar to the current study, had considered the 'Likert Scale' a more suitable and 'easy-to-administer scale' for measuring and analysing attitude studies, for similar reasons stated in Section 3.11 above, in this Chapter.

3.13 Possible Analytical Approaches

Direct observations carried out on a number of individuals over a predetermined number of selected variables is the first step in the traditional multivariate analysis. The second step is the choice of appropriate instruments or techniques, determined by the purpose of the analysis, and the type(s) of data; the purpose of the analysis being to reduce the large volume of variables initially considered, thereby revealing a latent structure for detailed scrutiny. This is achieved by identifying which of the originally considered variables or a combination of them, can be utilised as true representation of the initial large volume of variables derived from the collected data. Such data encompasses both general variance and total variance in the forms of principal components analysis, cluster analysis, multi-dimensional scaling, factor analysis, item analysis, and discriminate analysis.

Exceptions of cluster analysis and multi-dimensional scaling aside, all the above instruments require to operate on a priori classification of the original data. The data for this study has been derived from the respondents' replies given in the structured questionnaire administered to them on site. The questionnaire is arranged on a five-point "Likert-scale" instrument as generally used for such studies. Such material can therefore be analysed using cluster analysis, multi-dimensional scaling or item-analysis - these being appropriate instruments for attitudinal data analysis, for example, Henerson et al (1978), Saad, (1985), Vant, (1986).

3.13.1 Cluster Analysis

The purpose of Cluster Analysis is to group items (individuals or variables) which are highly similar in terms of likeness. The similarity of items is a composite, calculated from measurements on a set of variables (like-to-like) for each of the items being clustered or grouped. The application of cluster analysis encompasses two distinct phases, with regards to:

(a) the identification of appropriate measures of similarity, mostly referred to as a similarity coefficient, and,

(b) the most suitable method of clustering.

However, the identification of suitable applications for cluster analysis is not often as straight forward as widely propagated. For example, Alexander and Blashfield, (1984) pointed out that while classification is a fundamental stage or step in the process of scientific measurement or ordering, different sciences have differing problems that demand different solutions, and varying degrees of enquiry. As a result, it is not surprising that cluster analysis which is described as an objective means of classification, has taken many forms and definitions.

Whilst cluster analysis is a very valid and useful analytical instrument, its goal is to identify homogeneous groups or clusters. Therefore, it is suitable for data collected, for example, from unstructured questionnaires, or mainly from open-ended questions as used by Vant (1986). For data collected through use of open-ended, unstructured questionnaires, cluster analysis can be used to identify groups. When used for such cases, three basic questions need to be answered, for example:

(a) Which variables will serve as the basis for cluster formation?
(b) How will the distance between cases be measured? and
(c) What criteria will be used for combining cases into clusters?

The decisions arising from answers to these questions determines the use of cluster analysis, since the selection of variables to include in such an analysis is always crucial to its outcome.

For this study, the Likert Scale as an instrument determines the categorisation ratios from 1-5, and therefore does not need any form of group identification, since this criteria is controlled by the instrument itself. Also, the groupings from the 'Likert' Scale is based on individual items, readily classified according to the ordering of the strength of feelings or opinions (attitudes) of the respondent. Cluster analysis, was therefore discounted as an instrument of analysis for this study for the reasons given above.

3.13.2 Multi-Dimensional Scaling

The application of cluster analysis to the readily ordered data, as described in 4.2.2 above was discounted.

Also, statistical analysis by the use of the technique of multi-dimensional scaling to the attitude survey data was discussed as the research design stage. Its objective was that of obtaining a perceptual map(s) as a means of gaining a comparison between the prediction classification discussed in the literature reviewed in Chapter Two, and the views/opinions of the research constructs (respondents) to the questionnaires.

Multi-dimensional scaling technique attempts to represent the similarities between items or things geometrically, in what is generally described as a perceptual or special map. Carroll and Arbie, (1980) have described two ways of defining multi-dimensional scaling. According to the more general of the two definitions, multi-dimensional scaling means a set of techniques for estimating parameters in geometric models so as to obtain a true representation of the structure of data under consideration for analysis. Such a definition would totally encompass both cluster analysis and factor analysis. Nevertheless, these techniques generally, are considered as alternatives, and more acceptable definitions are given as:

(a) a set of statistical techniques for estimating the parameters in assessing the best fit of various spatial distance models for proximity or performance data, and

(b) the co-ordinated representations of stimulus structure that results from such statistical techniques (Davidson, 1984).

Multi-dimensional scaling differs on several criteria. The most common models apply to symmetric proximity data; measurements are defined over pairs of objects that quantify the degrees to which the two objects are similar. Correlation coefficients and joint probabilities are two examples of proximity data. A proximity measurement may be called a measure of similarity or dissimilarity, dependent upon whether the highest scores correspond to pairs that are most or least similar. In contrast to models for symmetric, proximity data are models for preference data. The data constitutes measurements defined over pairs consisting of a stimulus and a subject. Each measurement quantifies a subject's attraction to, or liking for, the stimulus object.

Despite the above, the type of measurement of a subject's similarity or attraction to, or liking for the stimulus object, will depend upon what form or type of multi-dimensional scaling technique is applicable. In the main, there are four basic types of techniques, these are:

(a) fully metric;
(b) fully non-metric;
(c) non-metric, and
(d) individual difference multi-dimensional scaling.

Each differs according to the kind of input data and output information used. Fully metric methods have metric input (interval or ratio scales data), and metric output, while fully non-metric methods have ordinal output and generate ranked output. The non-metric methods generate metric output from ordinal input (Church Jr, 1983 and Schiffman, Reynolds and Young, 1981).

Individual differences scaling, allows for differences in individual perception; basically these solutions contain, in addition to stimulus co-ordinates, a measure of how significant each dimension is to the perceptions of each subject/respondent.

Because of the various differences in the technique of multi-dimensional scaling, it was decided that detailed multi-dimensional scaling techniques be curtailed for this study. Instead, it was decided to follow advice from the Department of Mathematics and Psychology in Brunel University, and to expose the data for this study to the statistical techniques of item-analysis based on percentage tally, and correlation coefficient, a branch of multi-dimensional scaling, since the data was based on a Likert Scale of the ratio-type ranging from 0-5.

One of the main criteria for choosing this method of analysis is that attitudinal scalings, particularly the Likert-type scaling is a ratio scale, whilst other scaling, including linear regression analysis are predominantly ordinal scales. Item-analysis is therefore most suitable for attitudinal scaling.

3.13.3 Item Analysis

Measurement is the assignment of numbers or codes to observations. Levels of measurement are distinguished by ordering and distance properties.

The traditional classification of levels of measurements into nominal, ordinal, interval, and ratio scales was developed by Stevens (1946), as described in Norusis/Spss Inc, (1988). This remains the basic typology and is the one used in most texts of analysis.

In these measurement texts, statistical techniques of item analysis are described for making comparisons between how respondents performed on individual items and how they scored on the instrument as a whole.

The purpose of doing an item analysis is to select from a pool of items the ones that most effectively obtain the information wanted, and to eliminate the less effective items from the designed instruments of measurement.

Item analysis is performed by analysing each statement in the "Likert Scale" according to how high and how low scores responded to the statements. The scores could be expressed in percentage scores or numbers (frequency) scores, or both (Henderson, Morris & Fitz-Gibbon (1978).

For this study, a combination of percentage scores has been utilised, to display the responses for 'Historical' data, and the correlation coefficients and chi-square test of significance were used for the initial univariate analysis. Minitab statistical package was used for performing all the univariate and bivariate staistical analyses. Further multivariate analysis was then performed as a result of limitations found to be inherent in the univariate and bivariate analytical approaches. Details of the multivariate analysis are described under further analysis in paragraph 4.8 in Chapter 4 below.

3.13.4 The Scope of the Survey

The attitudinal survey was conducted by means of the "Likert-type" questionnaire instrument, administered to the employees of ten co-operating construction companies. All the companies in the sample were operating in general building and civil engineering construction operations throughout Great Britain. Most had international experience.

The employees within the sample were all currently engaged in the construction process at the time of the survey, and were directly employed by the companies in the study in various categories of trades/craft, and professional positions (see Tables 4.3, and other tables in the Appendix).

The methodology consisted of the use of literative reviews, interviews and questionnaires, to sample a cross-section of opinion in the construction industry, ranging from those operatives, to management, including some top management. It is believed that the attitudes and commitment of operatives and management towards safety, is a major influence on safety performance in the construction industry, hence their inclusion in the study.

The extent of the ranges of age, company size, individual and company experience, as well as the several factors covered within the research model (Chapter Three), are taken into account in the detailed analysis discussed below.

The views of Erdos (1970), Korn Hauser and Steatsley, (1959), Payne, (1951) and the "Survey Control Unit, Central Statistics Office", London, UK, (1975), were taken as guidelines for the evaluation of material detailed in the questionnaires, and are as follows:

(a) Is the question necessary?

(b) Is the question repetitious?

(c) Can the answer to the question be obtained more easily by any other means, eg. by simple observation or from existing records?

(d) Does the question contain more than one meaning or idea, that is, does it constitute a 'double-barrelled' question, and likely to lead to a confused answer?

(e) Is the question adequate as it stands, or should complementary questions be asked as a follow-up?

(f) Can the respondent answer the question, it, is it simple, or geared to his/her level of understanding?

(g) Will the question embarrass the respondent?

(h) Is the question clear and precise enough to present the same meaning to all in the sample?

(j) Would a memory-jogger help?

(k) Is the question too indirect?

(m) Should precoded answers be given in an endeavour to yield more accurate answers than open-ended questions?

(n) Is the questionnaire susceptible to an order effect?

(o) Can the items be arranged so that particular answers preclude the need to answer others?

(p) Is an item likely to cause bias to those following it?

(q) Does the sequence maintain interest or motivation?

(r) Is the opening or introduction to the questionnaire appropriate?

(s) Is the question simple enough to enable the respondent to read and understand the question(s)?

(t) Is the length or size of the questionnaire such that it does not become an inconvenience to the respondent etc?

3.13.5 The Questionnaire Design

The questionnaire designed and administered, is shown in Appendix Section A-D. Bearing in mind the findings of other past researches, Khan and Cannell (1957), Burch (1982), Sawacha (1982) and Dr Leather (1983), care was taken to try out the selected questions by carrying out an exploratory (pilot) survey on operatives, managers and safety advisers/directors in five companies in the sample. The pilot questionnaires were also posted to twenty company personnel managers for comments (including the five in the pilot study).

The survey was conducted within the site environment so as to bring reality to bear upon the research, and to accommodate environmental (external) influences, and constraints, which workplace is known to have upon subjects and safety performance (Surry, 1969; Hale et al, 1972).

Environmental factors are defined as:

> 'problems caused by external influences and constraints, which include the following:
>
> (a) weather conditions;
>
> (b) seasonality of employment, and mobility of employees;
>
> (c) the working environment (sites), and political influences (Surry, 1969; Hale and Hale, 1972; Thompson, 1967, Dill, 1958; and Dr Leather, 1983)."

Assistance given by the companies concerned in carrying out a survey of an exploratory nature on their employees and their workplace (sites), proved most valuable to the research design and final outcome.

Aware that questionnaires administered on individuals at their workplace or employment tend to yield a better response rate, Alluto, (1970); Carnegie, (1976)), the exploratory questionnaires were administered direct to the employees on site. This arrangement was previously agreed between the writer and the personnel managers, safety advisers and the site managers of the contributing companies. The questionnaires were collected immediately on completion by the respondents. No influence was brought to bear upon the respondents by the writer, or company managers either before, during or after the completion of the questionnaires. Discussions then took place between the writer, site managers, safety officers and the respondents. This was to avail the opportunity of an on-the-spot feedback about the questionnaire design. This feedback proved to be a great contribution to the shape, content, and design of the final questionnaires as contained in Appendices A - D hereto.

CHAPTER FOUR

The Research Analysis and the Interpretation of the Results

CHAPTER FOUR

4.0 THE RESEARCH ANALYSIS AND THE INTERPRETATION OF THE RESULTS

Purpose of the Analysis

The purpose of the analysis is to compare the predictive classifications described in chapters 2 and 3 previously, with the opinions of the respondents (constructs) to the questionnaires. These predictive classifications are based upon findings from previous research and literature examined for this research (see chapters 2 and 3).

The structure of analysis took the following stages:

1. Initial analysis (correlation)
2. Further analysis (multivariate analysis)
3. Comparison of safety behaviour / characteristics of the research constructs (subjects).

4.1 Initial Analysis (Correlation)

The initial analysis correlated the attitude data of the operative sample with the safety performance factors (accident experience) of the operatives. Details of the analytical steps are described in paragraph 4.4.

4.2 Further Analysis (Multivariate)

This analysis is an extension of the initial analysis described above. The aim of this analysis was to subject the operative data of attitudes and performance to multivariate analysis in order to strengthen the correlation analysis described in section 4.4. The end point of this analysis is an attempt to identify primary (dominant) variables which were strongly correlated with safety performance, and secondary variables which were loosely or uncorrelated to safety performance.

To achieve the above aim, the data was subjected to the following multivariate analysis processes using SPSS:

(a) Factor Analysis;
(b) Multiple Regression Analysis.

The results of this analysis are discussed below.

4.3 Comparison of Safety Behaviour of Operatives and Managers

This process of analysis followed a similar approach as the initial analysis described in section 4.1. Data was correlated, and significance was tested using chi-square analysis as contained in MINITAB.

The main aim of this analysis was to ascertain any similarities or non-similarities amongst the operative and site manager safety behaviours, and those of site manager and contract/safety managers.

The results of this analysis are discussed below in this chapter and chapter 5.

4.4 The Analysis and Results - Initial Analysis

3.13.3

After reviewing various possible analytical approaches as discussed in Sections 3.14 above, "Item Analysis" was chosen as an instrument for data analysis (described in 4.2.4 above). This instrument displays the statistical analysis of the questionnaire responses according to individual items or statements contained in the questionnaire. The details of each analysis show the results according to its frequency distribution and percentage scores per item. This process reduces the data by eliminating the less desirable items from the designed instrument of data collection, in this case, the "Likert-type" scale. Following this process of elimination, the coefficient of correlation and chi-square test of the most effective items was then calculated to test the hypothesis of the research for association validity and reliability of the calculated outcome (results).

The research analysis followed the following stages:

(a) Completed questionnaires were coded manually on receipt from the respondent companies.

(b) Data from the survey was then manually inputted on-line, into the computer mainframe in Brunel Computer Centre.

(c) A spreadsheet of each group (category) of the five sets of questionnaires were then produced and inspected to eliminate any errors or missing items.

(d) Data from the 356 subjects or sample population were then analysed and evaluated, using statistical techniques with the assistance of a statistical computing package called 'MINITAB', running on the mainframe computer housed in the Computer Centre within the campus of Brunel University.

This system was utilised for the data analysis mainly because data already stored within the mainframe system could be accessed interactively, using either MINITAB Statistical package or the SPSS package.

In summary, this section analyses the relationships between different variables (in the nature of "Behavioural" and environmental factors), and Safety Performance factors (accidents), of operatives within the elements of the research model (Ref: Fig 3.7).

It also compares the patterns of behaviour (attitude) factors (variables) between operatives and site management on the one hand and site management, contract managers, and safety officers/advisers as derived from the research data; and notes whether differences exist between their responses to the behavioural and environmental variables as detailed in the research model, sub-hypothesis, and null-hypothesis.

The central hypothesis is divided into sub-hypothesis, which is in turn separated into null-hypothesis (of no significance or no relationship/association), to allow the use of the statistical tests. The main statistics used are the percentage frequency for the "Historical" factors (variables) and for other variables, the correlation coefficients and the chi-square test of significance. The significance level is derived from the statistical tables, and the null-hypothesis was rejected having a significance of P=0.05 and under (see Statistical Tables by Murdock and Barnes (1979), second edition).

However, some relationships may show high correlation but were not considered conclusive because when subjected to the chi-square test, they suggested that 'chance' may have played some part in such relationships.

4.5 THE CENTRAL HYPOTHESIS

SAFETY PERFORMANCE IS A FUNCTION OF OPERATIVE'S AND MANAGEMENT ATTITUDES IN RESPECT OF BEHAVIOURAL AND ENVIRONMENTAL FACTORS (VARIABLES) IN THE CONSTRUCTION INDUSTRY.

4.5.1 Sub-hypotheses 1:

CI = SAFETY PERFORMANCE IS A FUNCTION OF OPERATIVE PERSONAL HISTORICAL FACTORS (VARIABLES) IN RESPECT OF: AGE, EXPERIENCE, TRADE OR OCCUPATION AND TRAINING (C1)

Null-hypotheses 1.1:

THERE IS NO RELATIONSHIP BETWEEN AGE, EXPERIENCE, TRADE OR OCCUPATION TRAINING AND SAFETY PERFORMANCE.

The literature reviewed for the study showed that the most significant factors of all accident causes relate to the age and experience of the worker. Vernon (1944) states that usually the two factors are so closely bound together that it is impossible to disentangle them.

The operative sample shows the most active age groups in the industry to be between 21 years and 45 years (see Table 4.5a). This fact is quite significant in that the nature of work and environment demand very good health in the operative, toughness for the conditions that exist in the industry, a high activity level and the need for a 'macho' image (Carnegie (1978), Pirani (1975), Shimmin (1976). Over 76 percent of the sampled population were between the ages of 21 and 45 years.

Churns (1968) contends that as ageing is a slow process, one can adjust to one's continually changing powers. Therefore, whilst one may continue to undertake the same work as one did when one was younger, one tends to do it in a different way. Thus, because of this ability to adjust, one can continue with a highly skilled activity which makes considerable demands on the perceptual and central mechanism well beyond the age at which we could ever hope to acquire such a skill from start.

Age Classification	Row	Frequency Count	Percentage Score
(a) Under 21 Years	1	4	3.71
(b) 21 - 25	2	25	19.84
(c) 26 - 30	3	17	13.49
(d) 31 - 35	4	19	15.08
(e) 36 - 40	5	19	15.08
(f) 41 - 45	6	15	11.90
(g) 46 - 51	7	7	5.56
(h) 51 - 55	8	10	7.94
(i) 56 - 60	9	7	5.56
(j) 61 years and over	10	3	2.38
TOTAL	(N)	= 126	100%

Table 4.5a *Q.7. Age Factors / Category*

Schulzinger (1956) demonstrated that accidents are most frequent in the age range seventeen (17) to twenty-eight (28) and that they decline steadily after that to reach a low point in the late fifties (50s) and sixties (60s). Furthermore, the tendency for individuals to experience more frequent injuries during their early years in the labour force, is one of the most consistent findings in the accident or safety field (Haddon, Suchman and Kline (1964)).

It has been shown by Grew (1958) that there are many jobs that are by tradition, the preserve of the young, and that when older workers are engaged in these jobs, they tend to be regarded as particularly prone to accidents. Grew stated that older men are unable to meet the demands of such job types, unless they are modified to match their capabilities. Vant (1986) suggests that:

"the age group 26-30 years (irrespective of background) are the happiest with physical aspects; this is not true of the under 25s who quibble about most things. However, taken as a whole, younger people (all under 30) had more grievances in general than older people (31+) for whom the physical aspects were beginning to become relatively more demanding vis-s-vis any other factor".

Similarly in construction (as far as these research interviews are concerned), those under 30 years old complained more about the general conditions of their work and its environment than their older counterparts (46 years or older), for whom the physical conditions of construction were viewed by many as requiring energy rather than technique or flair.

Pertaining to operative experience of individual companies, about nine percent (9%) of the sample had remained with their companies for less than one year. On the whole, people tend to stay with one company on an average from one to ten years before moving on (Table 4.5b). Forty-four percent (44%) were with their companies from one to five years, whilst only twenty-three percent (23%) had stayed with one company from between six to ten years on average (Table 4.5b). Those staying with one company for up to a period between twenty-six and over forty-one years constitute less than five percent (5%).

COMPANY SERVICE FACTORS: Classification	Row	Frequency Count	Percentage Score
(a) Less than 1 year	1	11	8.73
(b) 1 - 5 years	2	55	43.65
(c) 6 - 10 years	3	29	23.02
(d) 11 - 15 years	4	10	7.94
(e) 16 - 20 years	5	12	9.52
(f) 21 - 25 years	6	5	3.97
(g) 26 - 30 years	7	1	0.79
(h) 31 - 35 years	8	2	1.59
(i) 36 - 40 years	9	-	-
(j) 41 years and over	10	1	0.79
TOTAL	(N)	= 126	100%

Table 4.5b *How long have you worked for this company?*

Whilst the above indicates a high mobility level between companies, most construction workers liked to remain within the construction industry (Table 4.5b). Mobility of construction workers seems to be within the industry itself rather than movement from it to a completely new industry. Over ninety-two percent (92%) of the sample had moved from one company to the other, but had remained in the industry for between one to forty-one years (Table 4.5b, 4.5c). The industry maintains therefore a more or less stable workforce.

The rapid turnover of workers from company to company however, has a degree of implication for safety training and standardisation of safety procedures and performance audit which varies from one company to another. A preferred remedy would be to either standardise safety procedures and customs across companies, or to regulate training and retraining through induction each time a person moved from one company to another. The current practice seems to be an assumption that everyone who spent a year or so in the industry has received health and safety training sufficient to work anywhere in the industry (operative interviews). Compulsory safety induction on movement from one company to another, would hence ensure consistency, and also acclimatisation to new methods and the safety environments obtained in an organisation.

This finding confirms the association between age, experience, occupation/trade, training and safety performance, and a rejection of the null-hypothesis that there is no relationship between age, experience etc., and safety performance in the construction industry.

4.5.1 (a) **Conclusion of Sub-Hypothesis 1:**

SAFETY PERFORMANCE IS A FUNCTION OF OPERATIVE PERSONAL HISTORICAL VARIABLES: AGE AND EXPERIENCE; TRADE / OCCUPATION AND TRAINING = C3 vs. C10.

The review of past researches on accidents and safety has shown that most of the assumed ingredients of operative personal historical variables do have a strong association with safety performance (accident causation), and hence supports the hypothesis. The research interviews with operatives and site management also supports the hypothesis, and rejects the null-hypothesis of no association. The most significant contribution has been age and experience, occupation and safety training.

4.5.2 **Sub-Hypothesis 2:**

SAFETY PERFORMANCE IS A FUNCTION OF ECONOMIC VARIABLES (C10 vs. C4)

Null-Hypothesis 2.1:

THERE IS NO RELATIONSHIP BETWEEN PAYING OPERATIVES `DANGER MONEY' AND SAFETY PERFORMANCE.

A strong correlation was indicated between safety performance and paying operatives `danger money' (see chi-square test results, and correlation coefficient, significant at P=0.001 and null-hypothesis rejected (Tables 4.6, Appendix K). This result shows that sites or tasks where operatives are paid `danger money' are likely to have higher safety performance levels than those that do not pay it as an incentive.

The research interviews with operatives and management also indicate that `danger money' was perceived as a payment or incentive to take risks, and should be discouraged as a reward system or policy.

It is also very interesting to note the view that Union Stewards should negotiate the payment of a percentage 'danger money' for high-risk jobs was supported strongly by 26 percent of operatives and rejected by 56 percent, and 18 percent had no view either way. The results however further showed that only eight percent of companies paid 'danger money'.

Null-Hypothesis 2.2:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND BANKSMAN TRAINING.

The statistical analysis showed support to the null-hypothesis that there is no relationship between safety performance and Banksman Training (see results of chi-square test at 6.93; $p < 0.05$). In other words, it is not highly important to train Banksmen but it is necessary to do so to get the job done.

Nevertheless, 39 percent of the operatives sample felt that Banksmen should be better trained than is currently the case in the building industry to ensure improved safety operations where Banksmen are involved on the site. Only 27 percent disagreed.

Null-Hypothesis 2.3:

THERE IS NO ASSOCIATION BETWEEN 'BONUS PAYMENTS' AND SAFETY PERFORMANCE.

Statistical evidence showed that the null hypothesis can be rejected, as a strong correlation was found between 'bonus payments' as a productivity incentive and safety performance (see chi-square test results and correlation coefficient which showed significant at $p<0.001$). The explanation for this result might be that making bonus payments is not necessarily in opposition to the aims of safety performance - rather it could be seen as the linkage between productivity performance. This in itself could encourage the worker to increase his/her normal work tempo to a level which would influence safety performance.

The results of data analysis also indicate linkage between bonus payments and superior behaviour towards safety procedures (see results of chi-square test for psychological variables above and in Tables in Appendix K) (significant at $p<0.001$).

Null Hypothesis 2.4:

THERE IS NO RELATIONSHIP BETWEEN 'SAFETY BONUS' PAYMENTS AND SAFETY PERFORMANCE.

Statistical analysis of the research data showed evidence strong enough to reject the null hypothesis (see chi-square test and correlation coefficient), and an association exists between paying 'safety bonus' and improved safety performance (significant at $p<0.001$; see tables).

The above association means that operatives can be induced to work more safely without necessarily risking productivity by paying them a safety-related payment as an incentive to adhere to safety procedures, rules and safety policy. The explanation might be that 'safety bonus' payments to operatives promotes safety awareness, which means that operatives think 'safety' when paid extra to do so, and therefore take fewer risks in order to achieve an accident-free record.

Results of item analysis also showed that 63 percent of the operative sample believed that safety bonus discourages risk-taking behaviour and is highly significant in influencing a reduction of 'chance-taking' by operatives on site. An added explanation for this association might be that since they had nothing to lose by working safely - as in the case of productivity-related bonuses - they had to ensure that they safeguarded their accident-free record, thereby earning a financial reward. The finding was therefore that 'safety bonuses' enhanced safety management on site.

Null Hypothesis 2.5:

THERE IS NO RELATIONSHIP BETWEEN 'RISK-TAKING' AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient showed a highly significant association between risk-taking and safety performance levels on site (significant at $p< 0.001$, see tables). That means the higher the level of risk-taking , the poorer the safety performance level, and the lower the level of risk-taking, the lower the level of safety performance.

This finding is logical since as indicated by Null Hypothesis 2.4 above, safety bonus payments reduced risk-taking and hence improved safety performance levels and assisted site management in achieving better self regulation by the workforce under their control.

Although 72 percent of the operative sample believed that some level of risk-taking is inevitable in the job as part of individual self motivation, they suggested that the occasional chance-taking, particularly when the supervisor was not looking, was considered as part of the job itself. A similar conclusion was reached by Leather (1983).

Operatives and management interviews showed that the workforce felt safer and happier working with site managers on contracts where safety bonuses were part of the incentive scheme policy. They also perceived companies that implemented safety bonus schemes as more caring about their personal welfare amongst other things.

Null Hypothesis 2.6:

THERE IS NO RELATIONSHIP BETWEEN PRODUCTIVITY/ SAFE-WORKING AND SAFETY PERFORMANCE

Chi-square test and correlation coefficient results concluded that a strong association exists between productivity/safe working and safety performance (significant at p=0.001, null hypothesis can be rejected). That is, high productivity performance and safe-working can be achieved in parallel with good safety performance overall.

The general opinion held by 82 percent of the operative sample had equated good productivity schemes with good safety practice on site. Operatives and site managers believed that productivity in general and safe working ought to go hand-in-hand in safety management.

This outcome may explain the result of data analysis which indicates that close association exists between productivity bonus payments and safety bonuses and safety performance. It suggests that for good safety performance, productivity schemes must make allowance for safe working procedures and practices. In other words, there is a need to strike a happy medium between promoting incentive schemes and attaining good safety performance levels in the construction industry.

4 5.2 (a) **Conclusion of Sub-Hypothesis 2:**

SAFETY PERFORMANCE IS A FUNCTION OF ECONOMIC FACTORS (VARIABLES) (c10 = C4).

Statistical tests showed a very strong correlation between safety performance levels and all the assumed ingredients of the economic variables, which leads to the conclusion that safety performance is a function of economic variables and the strongest contribution resulting from overall good designs of safety productivity schemes. For example, non-payment of 'danger money', good safety training, productivity or reward systems designed to discourage risk- or chance-taking, with increased productivity performance, and ultimately good or effective safety/site supervision. All the other selected variables did have a correlation but to a lesser degree. No significant correlation existed between training of Banksmen and safety performance levels.

Economic Versus Safety Performance Variables - Test of Significance for Operatives Data : C4 versus C10

	Danger Money	Banksmen Training	Bonus	Safety Bonus	Risk - Taking	Productivity Pay
Safety performance	p=0.001 sign	p=0.05 not sign	p=0.001 sign	p=0.001 sign	p=0.001 sign	p=0.001 sign

TABLE 4.5.2(a): LEVEL OF ASSOCIATION (TEST OF SIGNIFICANCE - ECONOMIC VARIABLES)

4.5.3. Sub-Hypothesis 3:

C1 = SAFETY PERFORMANCE IS A FUNCTION OF PSYCHOLOGICAL FACTORS (VARIABLES) C10 vs. C5.

Null-Hypothesis 3.1:

THERE IS NO RELATIONSHIP BETWEEN CARE FOR PERSONAL SAFETY ON SITE AND SAFETY PERFORMANCE.

Site-based operatives who were most exposed to safety hazards were the main source for this data as it was hoped to establish the practical views of these operatives regarding their perception of their own personal safety on site and its assumed effect or the level of safety performance (accidents).

The statistical analysis of the data showed a significant association between the individual care for personal safety and safety performance; significant at p=0.001 (see results of chi-square test and correlation coefficient in Table shown in Appendix K). In other words, the higher personal care for safety shown by the individual, the higher the level of safety awareness of the individual. Also, the higher the compliance with Company Safety Procedures and policy, the lower the level of safety performance achieved by the individual operative. Most operatives considered their personal safety as the single most important factor in their work (94 percent of operative sample results).

Similarly, safety awareness by the individual and the group, is seen by site managers as an influential factor in accident reduction in the construction industry. This was the view of 96 percent of site managers interviewed during the research.

A logical explanation for this finding may be that the more safety aware a person is, the more effort is made by that person to avoid accidents, by taking more safety precautions, playing by the [safety] rules and, hence reducing the chances of an accident occurring to him/her.

Null-hypothesis 3.2:

THERE IS NO RELATIONSHIP BETWEEN CARE FOR WORKMATES' SAFETY AND SAFETY PERFORMANCE.

Statistical analysis of the data supported the null hypothesis that there is no relationship between care for workmates' safety and safety performance (see results of chi-square test and correlation coefficient, p=0.100 not significant in table 4.22 in Appendix K).

Construction work is generally a team/group activity, and the well-being of members of the team/group would be seen as essential to the morale of the team and good performance.

As a result of the above, it is surprising that the statistical analysis of the data should support the null hypothesis. The explanation may be that the individual concentration on personal safety is more powerful than group or team safety. However, it is reasonable to assert that individual care for personal safety will enhance the group/ team safety performance in a job/site situation.

Null-Hypothesis 3.3:

THERE IS NO RELATIONSHIP BETWEEN KNOWLEDGE OF THE 'HEALTH AND SAFETY ACT (1974) AND SAFETY PERFORMANCE.

Statistical tests showed a very strong correlation between knowledge of the 1974 Health and Safety Act and safety performance, and therefore reject the null-hypothesis that there is no relationship between knowledge of the 1974 etc. Act and safety performance.

It is interesting to note that 61 percent of the operative sample perceived knowledge of the Act to be a highly significant source for the creation of safety awareness in the construction industry and 55 percent of the sample had heard of the Act through their Trade Unions (Sawacha and Langford, 1986).

Null-hypothesis 3.4:

THERE IS NO RELATIONSHIP BETWEEN SAFETY TRAINING AND SAFETY PERFORMANCE.

Statistical analysis of the results indicated a mixed result for the null-hypothesis. For example, the correlation analysis showed a moderate support for the null-hypothesis. However, when subjected to a chi-square test, the result rejected the null-hypothesis (see Table 4.25 in Appendix K).

A possible explanation for this outcome may be the operatives' view, expressed during interviews, that training and experience must go hand-in-hand for any influence to be exerted upon working practices and safety performance.

Interview results showed that operatives saw safety and skills training and experience as the most important factors of influence on safety performance, on site and in the industry as a whole.

Whilst 86 percent considered safety training as the single most significant source of influence upon safe working, 60 percent (63%) thought experience in the industry and skills in construction were important factors for accident reduction.

Null -hypothesis 3.5:

THERE IS NO RELATIONSHIP BETWEEN OPERATIVE PERCEPTION OF CONSTRUCTION AS TOUGH AND DANGEROUS, PREPAREDNESS TO TAKE RISKS AND SAFETY PERFORMANCE.

The statistical analysis of the data showed a significant association between the perception of industry 'toughness', danger, preparedness to take risks and safety performance (see results of chi-square test and correlation coefficient in Table 4.26, Appendix K). (significant at p=0.001).

An explanation of the outcome could be that toughness perception induces 'macho' behaviour, and hence risk-taking (see Pirani *et al* 1976). The null-hypothesis is therefore rejected.

Null-hypothesis 3.6:

THERE IS NO RELATIONSHIP BETWEEN EXPERIENCE AND SKILL AND SAFETY PERFORMANCE.

Statistical tests showed a very strong correlation between experience, skills and safety performance of the operative (see results of chi-square test and correlation coefficient in Table 4.27 of Appendix K). (significant at p=0.001).

Interview results indicate 63 percent of operative sample considered the possession of industry skills and experience to be highly significant factors in the reduction of accidents on site and in the industry generally. The above evidence therefore rejects the null-hypothesis.

Null-hypothesis 3.7:

THERE IS NO RELATIONSHIP BETWEEN SUPERVISORS 'CAREFUL BEHAVIOUR TOWARDS SAFETY, AND SAFETY PERFORMANCE.

Statistical analysis of the research data showed enough evidence to reject the null-hypothesis (see chi-square test and correlation coefficient in Table 4.28, Appendix K. significant at p=0.001), and an association exists between careful behaviour and safety behaviour.

The above association means that site management, including supervisors, can influence operative safety performance by taking safety supervision seriously and showing operatives that they care about safety on site, by example. The explanation might be that operatives seeing site managers/ supervisors take safety seriously, would decide to "toe the safety line" and because they feel that the supervisor/site manager "means business" when he talks about safety. It would seem too that operatives' expectations of supervisors' safety behaviour is relatively high, since they see the supervisors' behaviour as being a great influence on their own.

Null-hypothesis 3.8:

THERE IS NO RELATIONSHIP BETWEEN WORKMATES' CARELESS SAFETY BEHAVIOUR AND SAFETY PERFORMANCE.

Statistical analysis of the date supported the null-hypothesis that there is no relationship between workmates' carelessness about safety and safety performance (see results of chi-square test and correlation coefficient in Table 4.29, Appendix K, p=0.10 not significant). The explanation for the above finding might be that operatives are too concerned about their own personal safety (as stated above) to pay attention to the careless behaviour of their workmates, despite the fact that workmates' carelessness could spell danger for their colleagues' safety.

The peer group behaviour as an influence, does not seem to have been borne out in this, as 69 percent of operatives disagreed when questioned, that their workmates' safety behaviour affected their own behaviour. Only 21 percent felt there was the possibility of their workmates' carelessness affecting them.

4.5.3 (a) **Conclusion of Sub-hypothesis 3**:

SAFETY PERFORMANCE IS A FUNCTION OF PSYCHOLOGICAL FACTORS (VARIABLES).

Statistical tests indicated a very strong correlation between safety performance and psychological variables, and most of the assumed ingredients of the psychological variables considered. This leads to the conclusion that safety performance is a function of psychological variables. The strongest contributions resulting from the effect of psychological factors are shown below:

Psychological vs. Safety Performance Variables - Test of Significance : Operatives' Data: C5 vs. C10

	Personal Safety	Workmates' Safety	H & S Act 1974	Safety Training	Tough's Danger & Risk-taking	Experience & Skills	Supervisor Care	Workmates' Care
Safety Performance	p=0.001 sign	p=0.10 not sign	p=0.001 sign	p=0.01 sign	p=0.001 sign	p=0.001 sign	p=0.001 sign	p=0.10 not sign

TABLE 4.4(a): LEVEL OF ASSOCIATION - TEST OF SIGNIFICANCE - PSYCHOLOGICAL VARIABLES

4.5.4 Sub-hypothesis 4:

C1 = SAFETY PERFORMANCE IS A FUNCTION OF TECHNICAL FACTORS (VARIABLES) C10 vs. C6.

Null-hypothesis 4.1:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND ASBESTOS HAZARD AWARENESS.

Operatives were the main source of this data since they were the most likely to be exposed to asbestos substances on site. It was hoped to establish the operatives' views of asbestos awareness and safety precautions in relation to asbestos risks. The statistical analysis of the data showed a significant association between asbestos awareness and safety performance in terms of exposure to asbestos (see results of chi-square test, and correlation coefficient in Table 4.30 of Appendix K, significant at p=0.02), hence rejection of the null-hypothesis that there is no relationship between asbestos awareness and safety performance (asbestos risk).

The result suggests that operative awareness of asbestos risk would lead to safety precautions being taken to minimise the risk of exposure.

Null-hypothesis 4.2:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND ASBESTOS RECOGNITION

Statistical analysis of the results showed no support for the null hypothesis that there is no relationship between safety performance and asbestos recognition (see chi-square test results and correlation coefficient).

The same reasons for the rejection of this null-hypothesis can be suggested as being similar to those for null-hypothesis 4.1 above.

Null-hypothesis 4.3:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND ASBESTOS HANDLING.

The null-hypothesis was supported by the chi-square test and the correlation coefficient, and as such, the above argument is valid (not significant, see Tables)

Null-hypothesis 4.4:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND ASBESTOS INFORMATION.

Chi-square test and correlation coefficient rejects the null-hypothesis (see table - significant at p=0.001).

Interestingly enough, most employee operatives (95 percent) of the sample showed awareness of the harmful effects of asbestos to health in the workplace; 50 percent (55%) indicated that they would recognise asbestos on site if they saw it, and 58 percent thought they were to blame should they handle asbestos on site without adequate protection. However 77 percent believed that the company had overall responsibility for the presence of asbestos within the site environment.

It is therefore not surprising that the null-hypothesis was rejected in view of the interview findings.

Null-hypothesis 4.5:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND PLANT/ EQUIPMENT OPERATION TRAINING.

Chi-square test and correlation coefficient supports the null-hypothesis (not significant, see Tables), concluding that no relationship exists between safety performance and plant operation training.

The original premise was that plant operation training (particularly mobile plant) would lead to a reduction of accidents caused by them. However, both statistical test results reject this association.

Null-hypothesis 4.6:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND POOR LADDER / SCAFFOLDING USAGE ON SITE.

Seventeen percent of the operative sample had suffered accidents involving falls from scaffolding and ladders in spite of the fact that 79 percent indicated the usage of specialist-erected scaffolding, well-tied ladders and regular inspections before use (see Table 4.15(b) in Appendix).

However, chi-square test and correlation coefficient rejects the null hypothesis that a relationship exists between safety performance and poor ladder and scaffolding on site (see result of chi-square test and correlation coefficient in Table 4.35 - significant at p=0.005).

Null-hypothesis 4.7:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND ADEQUATE SCAFFOLDING INSPECTIONS ON SITE.

Chi-square test and correlation coefficient rejects the null-hypothesis (significant at p=0.001, see Table 4.36 in Appendix K), thus indicating association exists between safety performance and scaffolding inspections on site.

The relevance of regular technical inspections of scaffolding and working platforms by someone qualified, was indicated by 79 percent of the operative sample, and only 14 percent thought specialist inspections to be unnecessary before use.

Both interview results and statistical tests therefore strongly reject the null-hypothesis that there is no relationship between safety performance and adequate scaffolding inspections on site.

Null-hypothesis 4.8:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE, COMMONSENSE AND BUILDING EXPERIENCE FOR SCAFFOLDING ERECTION ON SITE.

84 percent of the operative sample did not share the belief expressed at the pilot interviews that 'only commonsense and sufficient building experience (not training)' were required to erect a safe working platform and scaffolding structures on site. However, chi-square test and correlation coefficient (see Table 4.37, Appendix K, significant at p=0.001) indicate that good training, experience, as well as commonsense go hand-in-hand

The null-hypothesis that no relationship exists between safety performance and scaffolding training, only commonsense and training, was rejected.

Null-hypothesis 4.9:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND TRAINING/SKILLS FOR STEEL ERECTION.

The opinion that no training or experience was necessary to become a steel-erector (as suggested during site interviews) was not confirmed by the questionnaire response.

76 percent of the operative sample indicated that steel erection and scaffolding erection were a specialist activity and that technical/specialist training, skill and experience was necessary.

Chi-square statistical test, and correlation coefficient again rejected the null-hypothesis, and the above argument found to be invalid (see Table 4.38 in Appendix significant at p=0.01). There seems to be a very logical relationship.

Null-hypothesis 4.10:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND DUMPER DRIVING WITHOUT ADEQUATE TRAINING, ONLY COMMONSENSE.

Statistical tests and correlation coefficient supports the null hypothesis (not significant, see Tables).

A great degree of discrepancy seems to exist between the results of the statistical tests and the general opinion expressed at the site interviews. The latter indicated that some kind of certificate was necessary before anyone was allowed to operate or drive a dumper, or indeed any form of site transportation vehicle. This was the view of 75 percent and the general consensus was that only those persons who had received prior training or instruction be allowed to operate mobile and mechanical plant/tools on any construction site in order to minimize the level of accidents caused by site transportation etc.

The explanation for this disparity between opinion expressed and the statistical examination of the data may be due to the difference between 'actual' experience on site and expectations of the operative, or 'chance' playing a part in the statistical results, or both.

Null-hypothesis 4.11:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND PLANT DRIVER TRAINING.

Chi-square test and correlation coefficient found an association to exist between plant driver training and safety performance, and hence the above argument is rejected. It is logical that the training of plant drivers should be associated with safety performance (see Tables, significant at p=0.01).

4 5.4 (a) **Conclusion of Sub-hypothesis 4:**

SAFETY PERFORMANCE IS A FUNCTION OF TECHNICAL FACTORS (VARIABLES)

Technical Factors = C6 vs. C10 = Safety Performance

	Asbestos Awareness	Asbestos Recognition	Asbestos Handling	Asbestos Information	Plant Operation Training	Poor usage of ladder
Safety Performance	p=0.002 sign	p=0.001 sign	p=0.25 not sign	p=0.001 sign	p=0.75 sign	p=0.005 sign

	Scaffolding Inspection	Scaffolding Erection & Commonsense	Steel Erection & Skill Training	Dumper Driving & Training	Plant Driver & Training
Safety Performance	p=0.001 sign	p=0.001 sign	p=0.01 sign	p=0.25 not sign	p=0.01 sign

TABLE 4.5e: Level of Association (Test of Significance -Technical Variables)

Since statistical tests and correlation coefficient supported only two of the eleven null-hypotheses, and found association to exist between the compared variables in nine of them, it would be logical to assume that safety performance is a function of technical factors or variables as proposed. It is significant to state that the associations shown were statistically very strong indeed and as such the association found between safety performance and technical factors (variables) examined, is logically valid.

4.5.5. **Sub-Hypothesis 5**:

C1 = SAFETY PERFORMANCE IS A FUNCTION OF PROCEDURAL FACTORS (VARIABLES) C10 vs. C7.

Null-hypothesis 5.1:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND PROVISION OF SAFETY PROTECTIVE CLOTHING.

Chi-square test and correlation coefficient found an association to exist between the provision of protective clothing and safety performance and, hence rejects the null-hypothesis (significant at p=0.001, see Table 4.41 - Appendix K).

It is not surprising that the null-hypothesis is rejected by the statistical findings, since 91 percent of the operatives interviewed indicated that the supply of safety protective clothing and equipment etc. was the sole responsibility of the employer and management, and that safety protective clothing enhanced safety performance in the workplace.

<u>Null-hypothesis 5.2</u>:

THERE IS NO RELATIONSHIP BETWEEN WORKERS' NON-USE OF PROTECTIVE CLOTHING ETC AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient supports the null-hypothesis (not significant, see Tables 4.42 - Appendix), concluding that there is no relationship between non-use of protective clothing etc, and safety performance.

This result confirms the linkage between the supply of protective clothing and equipment to the workforce, their correct usage and safety performance.

<u>Null-hypothesis 5.3</u>:

THERE IS NO RELATIONSHIP BETWEEN ISSUING WORKERS' PROTECTIVE SAFETY EQUIPMENT AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient rejects the null-hypothesis. The Statistical analysis instead confirms an association between issuing workers with protective safety equipment and safety performance. The explanation for this is the same as for null-hypothesis 5.1 above.

<u>Null-hypothesis 5.4</u>:

THERE IS NO RELATIONSHIP BETWEEN SAFETY EQUIPMENT / CLOTHING TRAINING AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient supports the null-hypothesis (not significant, see Tables), concluding that: there is no relationship between safety equipment etc., training and safety performance.

Perhaps an explanation for the above may be similar to that for null hypothesis 4.10 above, i.e., training alone is inadequate without experience and some application of commonsense in the process.

<u>Null-hypothesis 5.5</u>:

THERE IS NO RELATIONSHIP BETWEEN PROVIDING WORKERS WITH SAFETY PROCEDURE BOOKLETS, WITH NO SAFETY INDUCTION, AND SAFETY PERFORMANCE.

Chi-square tests and correlation coefficient supports the null-hypothesis (not significant, see Table in Appendix), concluding that there is no relationship between safety procedure booklets and no induction, and safety performance.

The explanation for this result is that induction training must precede the provision of safety procedure booklets. What this means is that whilst it may be useful to give safety procedure booklets to the construction worker, they are considered no substitute for safety training.

Null-hypothesis 5.6:

THERE IS NO RELATIONSHIP BETWEEN PROVIDING WORKERS WITH SAFETY PROCEDURE BOOKLETS DURING INDUCTION TRAINING AND SAFETY PERFORMANCE.

Chi-square tests and correlation coefficient do not support the null-hypothesis (significant at p=0.001, see Tables), concluding that there is a strong relationship between providing safety booklets and training, and safety performance. This indicates that training with a safety procedure booklet has a significant influence on operatives' safety performance.

Null-hypothesis 5.7:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND SAFETY INDUCTION WITHOUT A SAFETY MANUAL ON SAFETY PROCEDURES ON AN EMPLOYEE'S FIRST DAY ON SITE.

Chi-square test and correlation coefficient supports the null-hypothesis (not significant, see Tables), concluding that no relationship exists between safety performance and safety induction with no safety manual.

The same argument given above in hull-hypothesis 5.6 could be applied in this result despite the strong correlation found in null-hypothesis 5.6 above (see Tables 4.46 in Appendix).

However, most operatives saw regular safety induction and updating of safety training - with regular reference to the Safety Manual/Procedure Handbook on Safety - as highly essential. 89 percent thought this would ultimately lead operatives into developing positive safety awareness and attitudes thereby leading to enhancement of safety performance.

4.5.5 (a) **Conclusion of sub-hypothesis 5:**

SAFETY PERFORMANCE IS A FUNCTION OF PROCEDURAL FACTORS (VARIABLES) C7 = C10.

On the basis of percentage responses by operatives to the above suggestion, there is an overwhelming support for the view that safety performance is a function of procedural factors (variables) in the construction industry (89 percent of the operative sample supported the argument).

However, statistical analysis based on chi-square test and correlation coefficient failed to support the sub-hypothesis.

As only three of the seven null-hypotheses subjected to critical statistical analysis rejected the null-hypothesis, and the remaining four supported them. It is reasonable to conclude therefore that there is only a partial correlation between the procedural variables examined and safety performance (see Table below).

Procedural Variables vs. Safety Performance Variables Test of Significance: Operative Data C7 = C10

	Provision of Protective Safety Clothing etc.	Non-use of Protective Safety Clothing	Protective Equipment etc.	Familiarity with use of Safety Equipment	Provide Safety Manual - no manual	Safety Manual + Induction	Safety Induction - no manual
Safety Performance	p=0.001 sign	p=0.25 not sign	p=0.001 sign	p=0.20 not sign	p=0.05 not sign	p=0.001 sign	p=0.020 not sign

TABLE 4.5f: LEVEL OF ASSOCIATION - TEST OF SIGNIFICANT - PROCEDURAL VARIABLES

4.5.6 Sub-hypothesis 6:

C1 = SAFETY PERFORMANCE IS A FUNCTION OF ORGANISATIONAL (VARIABLES) FACTORS - C10 = C8.

Null-Hypothesis 6.1:

THERE IS NO RELATIONSHIP BETWEEN SAFETY PERFORMANCE AND WORKER-MANAGEMENT RELATIONSHIPS ON SITE.

Like most human relationships, workers and management site relationships were assumed to have some influence on safety management and hence, safety performance on site.

Statistical analysis of the date supported the above assumption, but rejected the null-hypothesis.

Results of chi-square test and correlation coefficient found a very strong association between safety performance and worker-management relationships (see Table 4.48 in Appendix. significant at p=0.001).

Null-hypothesis 6.2:

THERE IS NO RELATIONSHIP BETWEEN TRADE UNION INVOLVEMENT 1N SAFETY, AND SAFETY PERFORMANCE.

The general view that Trade *Union involvement in* safety on site would lead to accident reduction was shared by 61 percent of the sample.

However, chi-square test and correlation coefficient of the data did not support the original view. Rather, the statistical analysis supported the null-hypothesis that there is no relationship between Trade Union involvement with safety and safety performance. The above argument though valid statistically, is not in-keeping with industry's view at the time of the Longitudinal Study and other research (see Leather (1983), Sawacha (1982) (unpublished)).

Null-hypothesis 6.3:

THERE IS NO RELATIONSHIP BETWEEN SUB-CONTRACTOR SAFETY BEHAVIOUR AND SAFETY PERFORMANCE.

Sub-contractors were perceived by 71 percent of the sample to be less careful and thoughtful about safety on site than main contractors

Whilst this view was also supported by the correlation coefficient analysis, it was rejected by the chi-square test (see Appendix K). This indicates that chance may have played a part in the overall outcome of the analysis and a firm conclusion cannot be drawn from this result alone. The null-hypothesis was supported by the chi-square test only.

The null-hypothesis 6.4:

THERE IS NO RELATIONSHIP BETWEEN HAVING SAFETY REPRESENTATIVES ON SITE AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient analysis reject the above argument (significant at $p=0.01$, see Tables 4.51 in Appendix), thus indicating an association exists between having a well trained and experienced safety representative on site and safety performance.

This outcome contrasts with the null-hypothesis 6.2 above, which moderately supported the argument that there is no relationship between Trade Union involvement in safety and safety performance. It is considered that the explanation given regarding the role of 'chance' remains valid in the first instance and not the latter.

The relationship between safety representatives and safety performance is well-evidenced in the industry both at site level and in previous research which validates the current findings (See Sawacha and Langford (1984)).

Null-hypothesis 6.5:

THERE IS NO RELATIONSHIP BETWEEN MANAGEMENT AND WORKERS' CO-OPERATION ON SAFETY AND SAFETY PERFORMANCE.

Evidence from the chi-square test and correlation coefficient rejects the null-hypothesis and found an association to exist between management and workers' co-operation on safety and safety performance (see Table 4.52 in Appendix K, significant at p=0.001).

This result is similar to that found in null-hypothesis 6.1 establishing a correlation between worker-management relationships and safety performance on site (see Tables 4.48 in Appendix, significant at p=0.001 respectively).

Null-hypothesis 6.6:

THERE IS NO RELATIONSHIP BETWEEN HAVING SAFETY COMMITTEES INPUT / ROLE IN SAFETY AND SAFETY PERFORMANCE.

Statistical tests showed significant results indicating an association between safety committee input/role in safety and safety performance (see Table 4.53 in Appendix K, significant at p=0.005). This result therefore rejects the null-hypothesis stated above, and does not support the argument.

The result is also logical in that, like null-hypothesis 6.4 above, the outcome clearly illustrates beyond reasonable doubt that both safety representatives and safety committees have an essential role to play in enhancing safety performance in the construction industry. The only proviso is that they are adequately trained and experienced in their duties as specified by the 1974 Act and all associated Regulations, since 1974.

Null-hypothesis 6.7:

THERE IS NO RELATIONSHIP BETWEEN WORKERS' BELIEFS IN OR PERCEPTION OF THEIR COMPANY'S SAFETY EFFORTS AND THEIR SAFETY PERFORMANCE.

Chi-square test and correlation coefficient supports the null-hypothesis (not significant, see Table 4.54 in Appendix), and it is logical that the perception of a company's safety efforts is not related to safety performance. It should be seen to be serious, rather than just paying 'lip service', through results.

Null-hypothesis 6.8:

THERE IS NO RELATIONSHIP BETWEEN FREQUENT SAFETY TALKS BY MANAGEMENT AND SAFETY PERFORMANCE.

Statistical tests showed no significant results which supported the null-hypothesis (see Tables of correlation coefficient and chi-square test 4.55 in Appendix) and that there is no relationship between frequent safety talks and safety performance.

However, it is interesting to note the moderate correlation between safety talks given by managers to operatives and safety performance, indicating some degree of association, albeit it not strong.

Null-hypothesis 6.9:

THERE IS NO RELATIONSHIP BETWEEN POSTER DISPLAY AND SAFETY PERFORMANCE.

Chi-square tests and correlation coefficient rejects the above argument that there is no relationship between display of safety posters on site and safety performance (not significant, see Tables 4.56, Appendix K). The only proviso is that they must be legible, and kept clean at all times.

4.5 .6 (a) **Conclusion of Sub-hypothesis 6**:

SAFETY PERFORMANCE IS A FUNCTION OF ORGANISATIONAL (VARIABLES) FACTORS - C10 vs. C8.

Statistical tests showed that several of the selected nine organisational variables had a strong level of correlation with safety performance. These were:

(i) Worker-management relationships;
(ii) Sub-contractor safety behaviour;
(iii) Safety representative presence on site;
(iv) Management-workers' co-operation;
(v) Safety Committees safety input;
(vi) Safety talks by managers/supervisors;
(vii) Display of safety posters on site.

However, the other remaining variables did not show sufficient evidence for such a relationship. These were:

(i) Trade Union involvement with safety;
(ii) Workers' beliefs in company safety efforts.

Both had significant correlation but low chi-square results.

Despite the low score of the above two variables, it could be concluded that safety performance is a function of organisational (variables) factors. Although the conclusion is logical, it must be emphasized that the number of variables selected to test organisational variables are not in themselves wholly definitive. Other variables could equally have been chosen to represent organisational factors, without affecting the results. For example, site organisation, gang size or make-up, management style etc. (see Table below for results).

Organisational Variables vs. Safety Performance Variables
Test of significance : Operative Date - C8 = C10

	Worker Mgt. Relation-ship	Trade Union involve-ment	Sub-contractor Safety Behaviour	Safety Reps.	Worker Mgt. Co-operation	Safety Cttee	Workers' beliefs of Co's efforts	Safety Talks	Safety Posters
Safety Performance	p=0.001	Not sign	p=0.02	p=0.01	p=0.001	p=0.005	Not sign	p=0.01	p=0.005

TABLE 4.5g: TEST OF SIGNIFICANCE - ORGANISATIONAL VARIABLES

4.5.7. **Sub-Hypothesis 7:**

C1 = SAFETY PERFORMANCE IS A FUNCTION OF ENVIRONMENTAL (VARIABLES) FACTORS = C10 vs. C9.

Null-Hypothesis 7.1:

THERE IS NO RELATIONSHIP BETWEEN CLEAN AND TIDY SITES AND SAFETY PERFORMANCE:

Chi-square test and correlation coefficient .showed very strong associations between clean and tidy sites and safety performance (highly significant, see Table 4.57 in Appendix) and hence rejects the null-hypothesis that there is no relationship between clean and tidy sites and safety performance. The above argument is therefore invalid. This means that clean and tidy sites have the effect of reducing accident levels.

Null-hypothesis 7.2:

THERE IS NO RELATIONSHIP BETWEEN JOB SKILLS AND KNOWLEDGE AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient again showed very strong association between job skills and knowledge and safety performance, and therefore rejects the above null-hypothesis (significant at p=0.001, see Tables 4.58 - Appendix K), This means that the more skilful and knowledgeable about the job in hand the better the individual safety performance.

Null-hypothesis 7.3:

THERE IS NO RELATIONSHIP BETWEEN UNTIDY SITES AND SAFETY PERFORMANCE.

Again chi-square test and correlation coefficient showed very strong association between untidy sites and safety performance, and hence invalidates the above null-hypothesis (see Table 4.59 - Appendix, significant at p=0.01).

This result also validates the result found in null-hypothesis 7.1 above. The indications from these results illustrates that clean and tidy sites can improve safety performance whilst untidy and less well-organised sites have the opposite effect.

Null-hypothesis 7.4:

THERE IS NO RELATIONSHIP BETWEEN CO-OPERATION BETWEEN WORKERS ON SITE AND SAFETY PERFORMANCE.

Statistical analysis of the data showed no support for the null-hypothesis that there is no relationship between co-operation between workers and safety performance. Therefore the above argument is rejected.

On the contrary, the results showed strong correlation between workers co-operating with each other and safety performance (see Table 4.60, Appendix K, significant at p=0.001).

The significance of this result is that where workers worked together in harmony with one another, there is the likelihood that an improved level of safety performance will be achieved, as opposed to where an atmosphere of non-co-operation prevails.

Null-hypothesis 7.5:

THERE IS NO RELATIONSHIP BETWEEN PROVISION OF COMPANY INSTRUCTIONS ON THE USE OF HARMFUL SUBSTANCES AND SAFETY PERFORMANCE.

The null-hypothesis was supported by chi-square test and correlation coefficient, and the above argument is therefore valid (not significant - see Tables). This argument was based on the provision of COSHH and it is possible that the newness of the COSHH Regulations at the stage of research may have accounted for the result. This is because the operatives may not have been too aware of the implications of the Control of Substances Hazardous to Health Regulations at the time.

Null-hypothesis 7.6:

THERE IS NO RELATIONSHIP BETWEEN MANAGER/SUPERVISOR SAFETY BEHAVIOUR (BY EXAMPLE) AND SAFETY PERFORMANCE.

Null-hypothesis was rejected by chi-square test and correlation coefficient, and the above argument is therefore invalid (see Table 4.62, Appendix).

This is a surprising result as both operatives and managers were consistent in their beliefs that operatives would "toe the safety line" always, provided supervisors and managers showed a good example.

Null-hypothesis 7.7:

THERE IS NO RELATIONSHIP BETWEEN PLANNED AND ORGANISED SITES AND SAFETY PERFORMANCE.

Chi-square test and correlation coefficient showed no support for the null-hypothesis, and the above argument is therefore not valid (significant at p=0.001, see Table 4.63 - Appendix K).

The result is very logical as it supports the outcome for null-hypothesis 7.1 and 7.3 respectively in that clean and tidy sites are more likely to be the ones which are well-planned and better organised thereby enhancing safety performance.

Null-hypothesis 7.8:

THERE IS NO RELATIONSHIP BETWEEN WORKER CAREFULNESS AND ALERTNESS ON SITE AND SAFETY PERFORMANCE.

Statistical analysis of the data did not support the null-hypothesis that there is no relationship between worker carefulness and alertness on site and safety performance.

The above argument is thus invalid, as it is rejected by the results of chi-square test and correlation coefficient (see Tables 4.64 - Appendix K),

4.5.7. (a) **Conclusion of Sub-hypothesis 7:**

SAFETY PERFORMANCE IS A FUNCTION OF ENVIRONMENTAL (VARIABLES) FACTORS.

Out of the eight selected environmental variables, only one supported the null-hypothesis; the remaining seven had strong associations with safety performance and therefore suggest support for the above sub-hypothesis.

The variables which showed support by virtue of chi-square test and correlation coefficient were:

(i) Clean and tidy sites;
(ii) Job skills and knowledge;
(iii) Untidy sites;
(iv) Workers co-operation with each other;
(v) Manager/supervisor's safety behaviour by example;
(vi) Planned and organised sites, and
(vii) Worker carefulness and observance or alertness.
(see Tables below)

Environmental Variables vs. Safety Performance Variables - Test of Significance : Operative Date C9 vs. C10

	Clean & tidy sites	Job skills & knowledge	Untidy sites	Worker co-operation	Company COSHH info.	Manager etc. safety by example	Planned & organised sites	Worker carefulness etc.
Safety Performance	p=0.01 sign	p=0.001 sign	p=0.01 sign	p=0.001 sign	not sign	p=0.01 sign	p=0.001 sign	p=0.01 sign

TABLE 4.5h TEST OF SIGNIFICANCE - ENVIRONMENTAL VARIABLES

NOTE: Figure 4.5 below shows the Established Correlation Coefficient of Operatives' Attitudes Annotated on the Research Model.

4.6. C2 : The Pattern of Behaviour of Site Managers and its Comparison with Those of Operatives - Test of Significance

The previous statistical analysis investigated the relationship between each of the selected variables or factors and safety performance as illustrated in the research model (see Table 3.8 above in Chapter 3). The results of the individual analysis are discussed above.

This section however, reports the pattern of behaviour of site managers as concluded from the research data and compares it with the results of operative data analysis (see Appendix L). It also investigates the differences in pattern of behaviour (if any) between site managers and operatives. The level of significance between both sets of data was measured using the chi-square analysis, and the results of the tests are discussed below.

4.6.1. Main sub-hypothesis 8 : C2 = Attitudes of Operatives towards Behavioural Environmental (Variables)/Factors differ from those of Site Managers

Null hypothesis 8.1: There is no historical difference in attitudes between operatives and site managers = C3 vs. C1 & C2

Examining the research data in respect of age, experience, occupation and training of both operatives and site managers, and those of previous researches as discussed in 4.5.1 above indicates support for the above null hypothesis.

The impact of age, experience, occupation and training is similar for both parties, and are found to be highly incidental to safety performance in most industries including the construction industry (Refer Churns (1968), Schulzinger (1956), Grew (1958), Haddon, Suchman & Kline (1964), Leather (1983) and Vant (1986)).

Null hypothesis 8.2 : There is no economic difference in attitudes between operatives and site managers = C4 vs. C1 & C2

(a) Chi-square analysis (test) indicates support for the view that bonus systems lead to reduced concern for safety on site (where C4 vs. C1 & C2, and χ^2 = 2.82 - not significant - see Tables in Appendix L/1) . Leather 1983) had similar research findings.

(b) Statistical analysis of operative and S.M. data showed strong support and association for the argument that 'Need to meet commercial requirements of profits influenced safety organisation on site' (see L/1).

(c) The result of chi-square test of significance showed that the view that 'bonuses lead supervisors to turn a blind eye to safety hazards' is valid, according to the response of operatives and site managers (see Tables in Appendix L/1, where C3 = Cl & C2, and χ^2 = 64.60 significant). Shimmin *et al* (1982) and Leather (1987), also found similar results.

(d) Statistical test of operative and site managers' response data showed that 'more training in safety leads to significant improvements in safety standards (see Tables in Appendix L/1, where C3 = C1 & C2, χ^2 = 21.68 significant at p = 0.001). Abeytunga (1979) reached a similar conclusion.

(e) `Safety bonuses improve safety performance'. This statement was supported by the cross-data analysis of the operative and site managers, and found the result to be significant (see Tables in Appendix L/1, where χ^2 = 25.75 significant, and C3 = C1 & C2).

(f) Chi-square test of significance validates the view that productivity drives with built-in safety incentives improve safety performance. (see Tables in Appendix L/1 where χ^2 = 19.10, significant, at p = 0.001, and C3 = C1 & C2).

4.6.2. <u>Sub-hypothesis 9 : C2 = Attitudes of operatives towards psychological variables) Factors differ from those of Site Managers</u>

Null hypothesis 9.1 : There is no psychological difference in attitude between operatives and site managers = C5 vs. C1 & C2.

(a) Chi-square test showed no support for the argument that 'increased safety awareness influences safety performance (not significant, see Tables in Appendix, where - χ^2 = 2.53, C5 = C1 & C2).

(b) Statistical analysis of operative and S.M. data showed support for the view that 'workers' behaviour on site influences safety performance' (where C5 = C1 & C2, χ^2 = 11.20 significant - see Table in Appendix L/2).

(c) Chi-square test showed very strong significance for the view that 'workers' perception of the Building work as tough and dangerous influences risk-taking behaviour' in the building industry (see Tables in Appendix L/2; where C5 = C1 & C2; χ^2 = 102.98, highly significant) refer Leather (1987), Pirani (1976).

(d) Chi-square test showed that the view that 'safety training and up-dating increases safety awareness and hence safety performance' (see Table in Appendix L/2 ; where χ^2 = 6.24, significant).

(e) Statistical analysis showed no support for the view that 'safety is a matter of commonsense' (where χ^2 = 1.58, not significant, C5 = C1 & C2) The argument that safety is a matter of commonsense is not valid.

(f) Chi-square test indicated no support for the argument that 'site managers' safety attitudes influenced workers' safety attitudes' (see Tables where χ^2 = 2. , not significant C5 = C1 & C2).

4.6.3 <u>Sub-Hypothesis 10 : Attitudes of Operatives towards procedural variables differ from those of Site Managers</u>

Null hypothesis 10.1 : There is no procedural difference in attitude between operatives and site managers.

(a) The argument that 'provision of protective safety clothing / equipment leads to safety awareness was found to be significantly valid by the chi-square test (see Tables in Appendix L/3; where χ^2 = 8.86 significant; C7 = C1 & C2). This is a logical finding as the provision of those safety items alone in itself does not affect attitudinal influences, but only provision of training and usage which does.

(b) Chi-square test showed support for the statement that 'workers failure to use protective safety clothing and equipment etc., be sanctioned in order to improve safety discipline on site' (see Table in Appendix L/3 where χ^2 = 3.45 significant - C7 = C1 & C2).

(c) Chi-square tests supported the argument that 'providing new workers with safety manuals, followed by induction, improves safety performance' (see Table in Appendix L/3, where χ^2 = 7.34, significant, C7 = C1 & C2).

(d) Statistical analysis showed support for the view that 'belief in receiving safety instructions on joining a new firm improves safety awareness' (where $\chi^2 = 5.66$, significant at $p = 0.02$, C7 = C1 & C4. see Tables).

4.6.4. <u>Sub-Hypothesis 11: Attitudes of Operatives towards Technical Variables differ from those of Site Managers</u>

Null hypothesis 11.1 : There is no technical difference in attitudes between operatives and site managers

(a) Operatives and site managers' data analysis indicates that the above argument is highly significant, and hence supports the null hypothesis (significant where $\chi^2 = 22.38$, and C6 = C1 & C2 - see Tables in Appendix L/4).

(b) Chi-square test showed a very high significance towards the argument that 'workers' ability to spot safety hazards on site leads to reduced accidents.' This means that hazard knowledge and hazard spotting/ identification should be encouraged as part of standard safety training at all levels of the industry from operatives to senior management. Such training and experience should pay rich dividends by creating risk-awareness and accident reduction as suggested by the statistical test (where $\chi^2 = 41.54$ high significant, and C6 = C1 & C2).

(c) Chi-square test showed no support for the statement that 'commonsense and building experience alone is sufficient for driving dumpers and scaffolding erection on site'.
This result means that driver training to acquire the relevant driving skills are a prerequisite for driving dumpers, mobile plant and for scaffolding erection. It rejects the view that commonsense and building experience alone was enough (see Table in Appendix L/4 , where $\chi^2 = 69.59$, highly significant; C7 = C1 & C2).

(d) The argument that 'hazard identification equals less accidents on site' was shown to be highly significant by the chi-square test (where $\chi^2 = 21.05$ significant - see Tables in Appendix L/4, C7 = C1 & C2).

The same explanation for (b) above is applicable to this result. It could logically be proposed therefore, that hazard knowledge creates hazard awareness, and that such awareness would lead to hazard identification and result in fewer accidents.

4.6.5. <u>Sub-Hypothesis 12: Attitudes of Operatives towards Organisation variables differ from those of Site Managers</u>

Null-hypothesis 12.1 : There is no organisational difference in attitudes between operatives and site managers.

(a) Worker-management relationships on site was seen by operatives' and site management to be highly significant. This was the result of chi-square analysis which indicated association between worker/management relationships and safety performance (see Tables in Appendix L/5, where χ^2 = 12.85, significant, and C8 = C1 & C2).

Similarly, statistical analysis of operative data (discussed above under null hypothesis 6.1), showed a high correlation of 0.754, and a chi-square test significant at p = 0.001, confirming the strong association between worker-management relationships and safety performance.

(b) Comparison of data analysis of operatives and site management showed agreement towards the argument that 'Trade Union involvement in safety reduces accidents on site' (see tables in Appendix L/5, where χ^2 = 17.07, significant, and C8 = C1 & C2).

(c) Chi-square test showed that workers safe-working systems and management co-operation was significant indicating comparison from operatives and site management (see Tables in Appendix L/5 , where χ^2 = 25.42, highly significant C8 = C1 & C2).

The same explanation for argument (a) above can be said to apply to this result This means that in order to achieve improved safety performance a workable level of co-operation between operatives and site management must prevail as well as having safe working systems in place.

(d) Chi-square test showed that operative data and site management data were in agreement that 'having safety committees improves safety standards (see Table in Appendix, whereχ^2 = 22.61 significant and C8 = C1 & C2).

This confirms the argument in (b) above as valid for both cases.

(e) The result of data analysis of operatives and site management seems to suggest that when operatives and site management discuss safety matters regularly, it has the effect of improving safety awareness and hence safety performance (see Table , Appendix L/5, where χ^2 = 4.58, just significant, C8 = C1 and C2).

(f) Chi-square test of operatives and site management data showed agreement between both groups that 'management safety attitudes determine or shape workers' safety behaviour as far as safety is concerned (see Table in Appendix L/5, where χ^2 = 17.37 significant and C8 = C1 & C2).

4.6.6 <u>Sub-Hypothesis : Attitudes of Operatives towards Environment or External Variables differ from those of Site Managers</u>

Null hypothesis 13.1 : There is no environmental difference in attitudes between operatives and site managers.

(a) Statistical analysis of data showed that both operatives and site managers are in significant agreement that 'unity building sites lead to accidents' (see Table in Appendix L/6, whereχ^2 = 17.06, significant, and C9 = C1 & C2).

Similar conclusions were found by Leather (1987) see reference.

(b) Chi-square test confirmed very high significance between operative and site management attitudes - thus agreeing that 'good job planning and site organisation lead to fewer accidents' (see Table in Appendix L/6 where $\chi^2 = 50.17$, significant and C9 = C1 & C2).

(c) Chi-square test again showed that 'workers who know their jobs, and are thoughtful of the way they work, have fewer accidents (see Table in Appendix L/6, where $\chi^2 = 44.83$, significant and C9 =C1 & C2).

Leather (1987) reached a similar conclusion (see ref. in bibliography).

4.6a Conclusions of Sub-hypothesis 8 : C2 = C1 : Attitudes of operatives towards behavioural and environmental variables differ from those of site managers

The statistical analysis (chi-square tests) for this section compared the pattern of behaviour (safety attitudes) of operatives to that of site managers in respect of the various 'behavioural and environmental' variables as considered in the research model illustrated in Figure 3.8 above. It investigates whether differences existed between the pattern of behaviour of operatives and site managers towards those behavioural and environmental variables shown in Figure 4.5 above.

The results of the statistical analysis are shown in Appendix L/4 and Appendix L/ 5 at the back of this thesis.

An examination of the results as detailed above in this Section 4.6, leads to the following conclusions:

1. There are no differences between operatives and site management attitudes towards historical variables in respect of:-

   (a) Age;
   (b) Experience (i.e., in-company and industry-wide experience);
   (c) Occupation and trade/craft, and
   (d) Training.

   All the above were found to impact upon safety performance.

2. There are no differences between operatives' and site management attitudes towards economic variables in respect of :
   (a) Bonus systems - not significant;
   (b) Effect of commercial needs - significant;
   (c) Safety training - significant;
   (d) Safety Bonuses - significant;
   (e) Productivity drive with safety incentives - significant = 0.001.

3. There are no differences between operatives' and site management attitudes towards psychological variables in respect of:-

(a) Safety awareness and safety performance - not significant;

(b) Workers' safety behaviour - significant;

(c) Workers' perception of the building industry as tough, dangerous and risk-taking behaviour - highly significant;

(d) Safety training and periodic up-dating - significant;

(e) Safety is a matter of commonsense only - not significant;

(f) Site managers' safety attitudes - not significant.

4. There are no differences between operatives' and site managers' attitudes towards procedural variables in respect of:-

(a) Provision of protective safety clothing and equipment significant;

(b) Workers' failure to use protective safety clothing and equipment - significant;

(c) Provision of safety manuals to new entrants to the industry together with safety induction - significant;

(d) Provision of safety instructions and up-date on transferring from one company to another (each time) - significant, $p = 0.02$.

5. There are no differences between operatives' and site managers' attitudes towards technical variables in respect of:-

(a) Having knowledge of hazards on site, and safety performance highly significant;

(b) Workers' ability to spot or identify safety hazards on site and accident reduction-highly significant;

(c) Commonsense and building experience enough to drive dumpers and mobile plant - significant only in terms of agreement that training and certification is relevant when driving on site, and in the erection of scaffolding.

6. There are no differences between operatives and site management's attitudes towards organisational variables in respect of:-

(a) Worker-management relationships - significant;

(b) Trade Union involvement in safety arrangements on site significant;

(c) Workers-management co-operation and safe working systems highly significant;

(d) Having safety committees in an organisation - highly significant;

(e) Managers' and supervisors' regular safety briefings on site significant;

(f) Management's behaviour on safety (attitudes) as a source of influence on workers' safety attitudes - significant.

7. There are no differences between operatives' and site management attitudes towards environmental variables in respect of:-

(a) Untidy building sites and accident occurrence - very significant;

(b) Good job planning and site organisation in relation to accidents - highly significant;

(c) Workers who know their jobs and who think about the way they work in relation to accidents - highly significant.

4.7 FURTHER ANALYSIS

OBJECTIVES

The main aim of the study is to strengthen the current analysis of the data and to meet the following objectives.

i) To identify primary safety attitudes variables which were strongly correlated with safety performance;

ii) To identify secondary variables which were loosely or unconnected to safety performance;

iii) To apply multivariate analysis to isolate key variables which enables influences of the variables upon one another to be partialled out.

ANALYTICAL APPROACH

The initial approach discussed above is based on bivariate analysis and involves correlating individual variables with a safety performance factor and chi-square tests were used to test the significance of the relationship. Without the use of multivariate analysis, intercorrelation between variables have not been accounted for and redundant variables have not been identified.

As a result of this limitation, multivariate analysis is used to strengthen the data analysis as indicated in objective three above in this section of further analysis.

COMPUTER HARDWARE/SOFTWARE

The multivariate analysis was conducted on an IBM compatible 80486 personal computer with a processor speed of 33 MHz, RAM of 16 MB, 340 Mb hard-disk, SVGA colour display, preloaded with MSDOS version 6.2 operating system and windows 3.1 graphical environment.

SPSS for Windows was selected as the main data analysis software due to the following reasons:

- Very widely distributed in educational establishments, research institutions and industry
- Windows interface render user-friendliness, ease of use, and facilitates data exchange

between Windows applications

- Offers a very wide range of analysis and presentation tools
- Well documented with manuals and books published by an independent publisher which ensures availability in bookstores
- Proven and well developed software with technical support from distributor
- Offers portability across various computer platform

Excel for Windows was also used on various occasions for data manipulation and presentation.

4.7.1 PRIORI ANALYSIS

Operative attitudes data from 126 respondents were examined for accuracy of data entry, missing values, and fit between their distributions. The 56 variables identified together with 2 variables used in measuring safety performance were examined separately.

Preliminary Data Screening

Unusual Data

i) Data with exceptionally large values were suspected to be caused by entry error. Variable C19, CARES, was found to contain a value of 22, variable C53, SENSE, contained 22 and 44, and variable C87, PLAN, had value of 33. In all cases, the obscure data were truncated by one digit and thus 22 becomes 2 and so on. Another possible entry error was detected in variable C88, AVOID, with a value of 7. The case was replaced by a value of 1.

ii) Cases with 0 values were assigned a value of 3 as 3 represent the 'don't know' category in the questionnaire. Variables which contained 0 values include HELMET (C39), TIDYSITE (C81), SAFEINSP (C89).

iii) Certain safety performance variables contain data values close to their variable labels, for example, variable C97, PLATFORM, contained value of 97. A value of 7 was assigned to replace the exceptional values. Other variables which contained similar abnormal data include ROOFS (C98) and SHOES (C99).

Defining Data Variable

One new composite variable was created to represent the overall safety performance factor as a single measure which embraces the summation of all individual safety performance factor (C97 - C109):

PERFORM = PLATFORM + ROOFS + SHOES + HEIGHTS + COLLAPSE + EYES + FALLS + LADDERS + HOLES + CRANE + TRANSPOR + FIRE + SHOCKS

All changes to the original data file were highlighted in the spreadsheet of Appendix I.

Fine-Tuning File Structure

As multiple regression analysis was expected to be employed, categorical variables without ranking was deleted from the data file, leaving only ordinal variables present in the file in order to facilitate further analysis to be carried out.

Normality

Skewness and Kurtosis of variables including the combination variable PERFORM are tabulated to examine normality of variables. Significance tests for both Skewness and Kurtosis that test the obtained value against the null hypothesis of zero can be carried out. The p-values for two-tailed test are tabulated along with the Skewness and Kurtosis. (Refer Appendix)

The research involves a relatively large sample size and consequently conventional alpha levels used for the evaluation of the significance were not employed in this study. Instead, the p-values of the variables were examined together with their expected normal probability plots and detrended expected normal probability plots. Variables with exceptionally large Skewness or Kurtosis, or both, were further investigated with normal distribution overlaid frequency histograms.

Non-normal variables identified are as follows:

Data Transformations

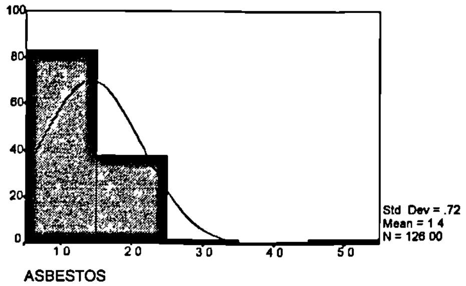
Transformation equations were assigned to render the data distribution normal. The equations for non-normal variables were determined by visual examination of the frequency histograms and trial and error.

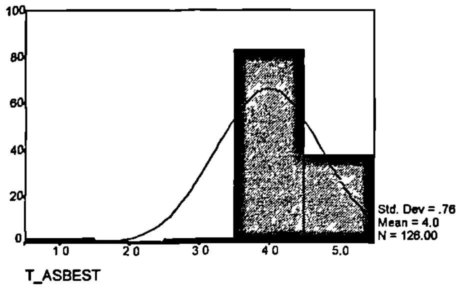
ASBESTOS

The data showed a high degree of positive Skewness (2.5749) and leptokurticity (9.2013). The following transformation equation was used to obtain normality:

$$T\_ASBEST = 3 + \frac{1}{2.5 - ASBESTOS}$$

The transformed variable, T _ ASBEST, shows a moderate degree of negative skewness (-0.539) and leptokurticity (2.411).



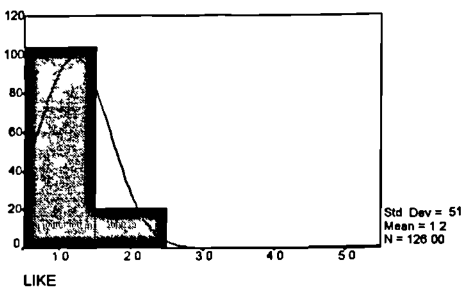


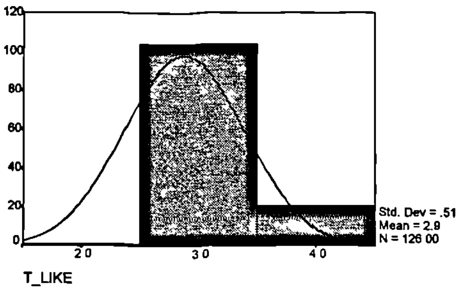
LIKE

The Variable has a high degree of positive skewness (4.068) and a very high degree of leptokurticity (24.738). A similar inverse function to equation (1) was applied to transform the data:

$$T\_LIKE = 2 + \frac{1}{2.5 - LIKE}$$

The transformed variable, T _ LIKE, has skewness of 1.6 and a kurtosis of 1.326.



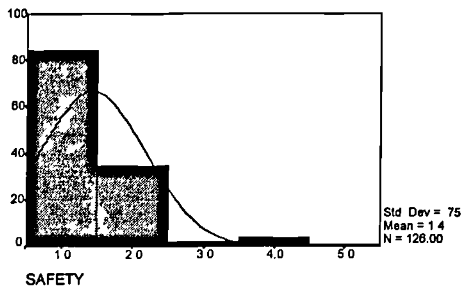


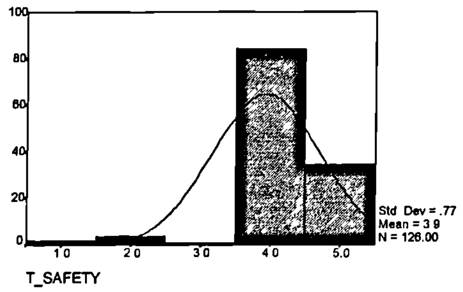
SAFETY

The variable exhibits a high degree of positive skewness (2.271) and leptokurticity (6.100). An inverse function was used to modify the variable:

$$T\_SAFETY = 3 + \frac{1}{2.5 - SAFETY}$$

The transformed variable, T _ SAFETY, reveals a negative skewness (-0.537) and a moderate kurtosis of 2.158.



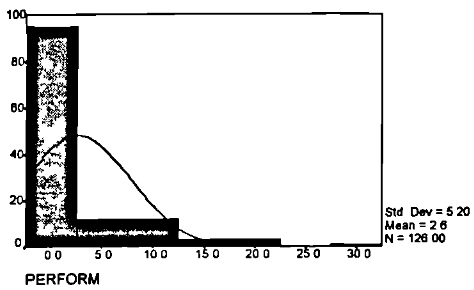


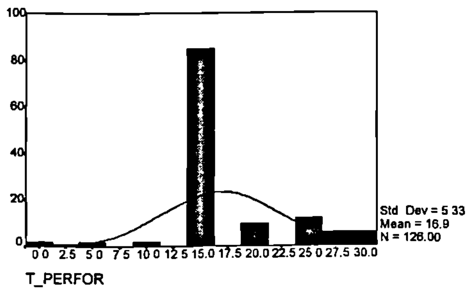
PERFORM

The newly defined aggregate variable has strong skewness (2.728) and leptokurticity (8.854). A trigonometric function was used for the transformation:

$$T\_PERFOR = 15\left[1+\sin\left(\frac{PERFORM \times \pi}{10}\right)\right]$$

After transformation was applied, the variable T _ PERFOR has Skewness of 0.382 and a kurtosis of 0.769.





Multicollinearity

The correlation matrix of the 56 variables in Appendix K1 demonstrates a moderate to high intercorrelation among the variables (in excess of 0.30). As a result, correlating between individual variables and the safety performance may lead to distorted result. Factor analysis was employed to combat the problem. The full analysis will be presented in the next section.

4.7.2 FACTOR ANALYSIS

Factor analysis (or Principle Component Analysis) was utilised to eliminate multicollinearity problem discussed in the previous section by producing uncorrelated factors or components from the original variables. Another advantage of employing the method is that large amount of variables can be reduced to a small number of factors, which concisely describe the relationships between the variables and the safety performance factors.

Factorability

Test of factorability was performed on SPSS for Windows. Using the Bartlett's Sphericity Test of which the null hypothesis H_0, supposes variables not correlated and therefore unsuitable for factor analysis, the value obtained was 3093 with a significance of 0.00000.

Another test applied to confirm the factorability was Kaiser-Meyer-Olkin's measure of sampling adequacy. The ratio of the sum of squared correlations to the sum of squared correlations plus sum of squared partial correlations was 0.57, which is just adequate for conducting factor analysis.

Extraction of Factors

Factor analysis was applied to the 56 safety attitude variables using principal components method for factor extraction. As to decide the number of factor to retain, Kaiser's rule was used to extract factors whose eigenvalues were greater than 1. In order to verify the Kaiser criterion, variable communalities were calculated and shown in the Final Statistics section of the Appendix. Since 54 of the 56 communalities are either greater than 0.7 or very close to 0.7, the default criterion is accurate in identifying the true number of factors.

19 factors with eigenvalues greater than 1 which accounted for 71.7% of the total variance were extracted, and listed overleaf. A scree plot of the eigenvalues was included in the Appendix which presents the cut-off point graphically.

Factor Matrix

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
AGE	-.12346	-.04247	.53899	.47756	.14765
ASBESITE	.06910	.24693	-.07871	-.02082	-.36278
AVOID	.38744	.03571	.09705	.21393	-.03882
BANKSMAN	-.06157	.02596	.01546	.04905	-.40667
BELIEVE	.57358	.23441	.14737	-.21114	.06075
BLINDEYE	.03694	.09871	.50958	-.39828	-.29246
BONUS	.05479	-.08877	.32041	-.60888	-.10678
CAREFUL	.16383	.06438	-.16134	.10202	.26601
CARES	.20786	.06927	-.45423	.14209	.20768
CAUSE	-.26288	.41404	-.38879	-.10663	.31447
COMMITEE	.54582	.16070	-.22912	.18943	.00569
COOPERAT	.41397	-.22450	-.03321	-.16648	.22674
DUMPER	-.17985	.09230	.20469	.22193	-.01444
ENOUGH	.17090	.09098	-.43131	.05936	.26821
EQUIP	.68687	.22216	.07304	-.12657	.18339
ERECTOR	-.19451	.51553	-.05763	.08089	-.06385
EXAMPLES	.14347	-.02120	.19318	.00839	.50282
HANDLE	.29024	.09970	-.26145	.05353	-.38962
HELMET	.49052	-.10522	.11461	.08249	-.12299
INDUSTRY	-.17226	.00277	.46553	.54147	.10966
INVOLVE	.27734	.34706	.02470	.16943	-.31534
JOBS	.27660	.12995	.17523	.24257	.09153
LESSACCI	.46628	-.22924	.22168	.28590	-.17852
MECHAN	.46025	-.58190	.18006	-.04553	.05001
MONEY	.14237	.21442	.18048	.30843	-.33607
OPERATE	.56187	-.28866	.02734	-.06509	-.00265
PLAN	.55836	-.00776	.11392	.31028	.12018
POSTERS	.43874	.04898	-.07390	.04711	-.04387
PRODUCT	.43900	-.16527	-.33317	.13129	-.21255
PROPER	-.22404	.44979	.08736	.16402	.25306
PROTECT	.59082	.22410	.06267	.07547	-.00594
REDUCE	.24054	.42604	.10661	-.06729	-.30676
RELATION	.26517	.20863	.15158	-.00163	.17797
RISKS	-.12659	-.00051	.05830	-.28110	.23857
RISKY	-.30923	-.07674	.34461	-.03288	.32817
SAFEACT	.35663	.07672	-.33280	.23295	-.15619
SAFEBOOK	.71314	.29091	.14482	-.19314	.24038
SAFEINSP	-.08582	.36656	-.32297	.04348	.29315
SAFEREP	.58229	.12618	-.02638	.08967	-.15956
SCAFFOLD	.54183	-.20219	.07982	-.19183	.16941
SENSE	-.29053	.31522	.06245	.19152	.01390
SERVICE	.01493	-.03674	.36038	.60948	.21231
SITE	-.08266	.27821	.24192	-.17791	.03860
SKILLFUL	.15278	-.28260	.00948	-.02374	.21046
SUBCONT	.40461	.04118	.07501	-.20963	-.06411
SUPERV	.07668	.47792	.34555	-.07736	-.02052
T_ASBEST	.25336	.04216	.01391	.08500	-.02066
T_LIKE	.28272	-.16668	-.23953	.09604	-.16019
T_SAFETY	.01079	.44786	-.17425	.12244	-.03568
TALK	.73257	.34895	.17287	-.21132	.19484
TELL	-.33395	.15010	-.08642	.21895	.07208
TIDYSITE	.59277	-.24674	.02872	.12171	-.09802
TOXIC	.09139	.16925	.13961	-.05866	-.18700
TRAINING	.51302	-.15928	-.15586	.18243	.16681
WEAR	.42839	.18587	-.12536	-.12465	.27008
WORKMATA	.02376	.39023	.21027	-.23491	-.03411

	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10
AGE	.21635	-.28814	-.11424	-.24324	.07506
ASBESITE	-.15399	.06431	-.11547	-.12454	-.12903
AVOID	-.42617	.23526	-.01665	.15322	.11854
BANKSMAN	.02605	.26244	-.02140	.10064	.13201
BELIEVE	.04600	-.15458	-.15952	-.03233	-.08834
BLINDEYE	.12323	.00491	.04702	.16626	.21611
BONUS	.11301	.06620	-.31066	-.05181	.14671
CAREFUL	-.03553	-.09686	.09420	.58590	-.20612
CARES	.26108	.25542	-.24881	.15039	.15721
CAUSE	.24092	-.24346	.07331	-.06939	.05525
COMMITEE	-.23000	-.18317	-.05704	-.03263	-.12473
COOPERAT	-.04010	.05647	.13457	-.30123	-.23191
DUMPER	.43646	.39656	.15825	.06734	-.05789
ENOUGH	-.17673	.07514	-.10535	-.10967	.30916
EQUIP	.13166	.10507	-.28192	.00667	-.25166
ERECTOR	.00902	.35311	.14161	-.06052	.02021
EXAMPLES	.22348	.26846	.17585	.09503	.21747
HANDLE	.21888	.15886	.00903	-.25447	-.05015
HELMET	.34963	.02222	-.25931	.15243	.05254
INDUSTRY	.21628	-.29043	-.16259	-.18832	.00760
INVOLVE	-.20734	-.26423	.12649	.12993	.02113
JOBS	-.52520	.10573	-.25667	-.03825	-.03007
LESSACCI	-.19112	.20862	-.10376	.10755	.27987
MECHAN	.03901	.04440	.28797	.14251	-.07246
MONEY	-.03117	-.09747	.09830	-.05626	-.31341
OPERATE	.04945	.03256	.28779	-.05272	.20522
PLAN	-.08084	.36216	-.00235	.14030	.03386
POSTERS	.23125	-.02953	.16368	-.11035	.41998
PRODUCT	.13236	.17362	.01727	-.16271	.02646
PROPER	-.27898	-.03210	-.13529	.18141	.08898
PROTECT	.29750	.20924	-.20569	-.12379	-.33161
REDUCE	-.00220	-.19446	.06933	.23001	-.02653
RELATION	-.20053	.13422	.35755	-.24031	.29310
RISKS	-.02793	.26931	.19026	-.02957	-.09294
RISKY	-.02025	.16108	.02394	-.09005	-.24196
SAFEACT	.26738	-.16320	-.06236	.21725	.01588
SAFEBOOK	.14289	.03803	-.01930	-.09835	-.13262
SAFEINSP	.22605	-.26855	.26272	.04633	.04045
SAFEREP	.04328	-.23479	.33558	-.12412	-.00995
SCAFFOLD	-.32696	-.18715	.16987	.03593	-.19071
SENSE	.09311	.43223	.16846	.12803	-.00064
SERVICE	.05302	-.12585	.15307	-.09077	.00833
SITE	.18050	-.16206	-.12468	-.11446	.36778
SKILLFUL	-.01948	-.26659	-.11435	.54176	.18297
SUBCONT	-.03996	.03203	.41778	.01066	.21444
SUPERV	.09849	-.04519	.09153	.27298	.10358
T_ASBEST	-.04843	-.15369	-.00357	-.24314	.36160
T_LIKE	.26884	-.03246	-.11665	.11428	.10776
T_SAFETY	-.22616	-.00761	.06199	-.16190	.09997
TALK	.09914	.02171	-.14418	-.03705	-.18918
TELL	-.00900	.37065	.03934	.15378	-.05302
TIDYSITE	-.08020	.14675	-.06010	.00123	.04818
TOXIC	.09443	-.05523	.50111	.20075	-.25823
TRAINING	.09888	-.15435	-.00241	.15816	.01421
WEAR	-.14666	.04439	-.04131	-.21326	.08170
WORKMATA	-.12988	.04744	-.22903	.20719	.18292

	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15
AGE	.03909	.21135	-.03623	.07112	.09678
ASBESITE	.03840	.31948	.36946	.25035	-.26773
AVOID	.08859	.16046	.01775	-.14159	-.17948
BANKSMAN	.32868	-.07745	-.07514	-.21383	.36007
BELIEVE	.26198	-.06494	-.14330	-.02445	-.24313
BLINDEYE	-.13132	.15013	.14855	-.18275	-.02189
BONUS	-.13488	.00258	.15588	-.03255	.00419
CAREFUL	-.05482	.09286	.03628	.03339	.32225
CARES	-.10527	.15081	-.23452	.10061	-.03352
CAUSE	.02002	.06411	.15909	.03584	-.05202
COMMITEE	.18583	-.04752	.15690	.08701	-.12946
COOPERAT	-.03361	.12558	-.17625	.23501	.19300
DUMPER	.09488	-.22497	.04666	.06747	-.26221
ENOUGH	.12238	.22218	-.22405	.15310	-.07261
EQUIP	-.13184	-.11132	.07961	-.05624	.03359
ERECTOR	.10468	.11458	-.04724	-.06150	-.30806
EXAMPLES	.06985	.10081	.16356	.21901	.02828
HANDLE	.23200	.27575	.21903	.22752	.14707
HELMET	.11015	-.17199	-.00579	-.07625	.01863
INDUSTRY	.03998	.20845	-.02287	-.16249	.02297
INVOLVE	-.04021	-.21849	-.05130	.15504	.11651
JOBS	-.23245	.11945	-.09871	.04152	.00469
LESSACCI	-.21313	-.18806	.02400	.09587	.00660
MECHAN	.07551	-.00706	-.05763	.01618	-.09826
MONEY	-.00297	.12113	-.24912	-.15086	.04468
OPERATE	-.19716	.06298	-.19011	.07061	.16530
PLAN	-.19428	-.07793	.08774	-.10951	-.12040
POSTERS	.10239	-.00227	-.32409	-.13069	-.17352
PRODUCT	.09497	.19032	.08345	-.34886	-.09739
PROPER	.32041	-.11319	-.17765	.00824	.04332
PROTECT	-.16634	-.12209	.00712	-.04308	.07918
REDUCE	-.00548	.21259	-.15684	.01273	.17979
RELATION	-.08808	-.07276	.20882	-.03272	.01855
RISKS	-.20367	.31731	-.02179	-.13820	.22938
RISKY	.07385	.39788	-.06369	-.21353	-.10931
SAFEACT	-.15620	.15928	.16026	-.19262	.09247
SAFEBOOK	-.04492	-.12097	-.05051	.04917	-.03513
SAFEINSP	-.23206	-.05533	-.09016	-.17788	-.07922
SAFEREP	.03768	-.25897	-.12622	.12811	-.01898
SCAFFOLD	.27334	.14758	.06341	.03669	-.04076
SENSE	.27101	-.16917	.06948	.03203	.06016
SERVICE	.08944	.01721	.13359	.04884	.07380
SITE	.30289	.05324	.20798	.29848	.21807
SKILLFUL	.11011	-.02411	.29498	.01474	-.17771
SUBCONT	.22172	.10885	-.05848	-.19241	.15960
SUPERV	-.22154	.12552	.01547	.01664	.01823
T_ASBEST	-.46001	-.03942	.03000	.11313	-.15460
T_LIKE	-.03334	.33606	-.16760	.16427	.03859
T_SAFETY	-.27885	.06155	.33665	-.22623	.19498
TALK	.02134	-.07410	-.02511	.06362	.07801
TELL	-.12804	.01441	.01732	.26931	.22503
TIDYSITE	.10476	.12135	.10226	.21640	.11481
TOXIC	-.07863	.16529	.07350	.22801	-.27526
TRAINING	.11083	.21792	.24179	-.21336	-.05252
WEAR	.26690	-.15720	.15077	-.28873	.17319
WORKMATA	.05587	.26962	-.32356	.03885	-.11827

	Factor 16	Factor 17	Factor 18	Factor 19
AGE	.06718	.13754	.03042	-.17368
ASBESITE	.13500	-.14682	.07279	.20558
AVOID	.11562	.14650	-.12352	-.01770
BANKSMAN	.24499	-.18693	-.12890	-.17614
BELIEVE	.15847	-.02266	-.05415	-.14555
BLINDEYE	.06963	.18661	.03365	-.09659
BONUS	-.00158	.19807	-.07129	-.01933
CAREFUL	.21588	.09578	-.00592	-.13612
CARES	-.18339	.21500	.07897	.03916
CAUSE	.17514	.11772	.00527	.17350
COMMITEE	-.04624	.14049	.10200	-.22519
COOPERAT	.06252	.26376	-.28172	.11439
DUMPER	-.00362	-.06821	.03523	-.03877
ENOUGH	.07469	.01588	.19470	.03613
EQUIP	-.01359	-.06254	-.07180	-.00204
ERECTOR	.09800	.13655	.22861	-.14584
EXAMPLES	-.05943	.14873	.04463	-.03551
HANDLE	-.05677	.02795	-.06017	-.08146
HELMET	.06057	-.04939	.31280	.20128
INDUSTRY	.08717	.18091	.09542	-.06437
INVOLVE	.05004	.38537	.24314	-.03261
JOBS	.07406	-.14959	-.10775	-.12784
LESSACCI	.00971	.06567	.20017	-.04573
MECHAN	-.05737	.00858	.11524	.15857
MONEY	-.10352	-.04610	.10462	.47114
OPERATE	-.00431	-.23763	.20007	-.09531
PLAN	.03308	.16459	-.24825	.06293
POSTERS	-.10354	-.03356	-.23176	-.03968
PRODUCT	-.05534	-.10234	-.02634	-.15964
PROPER	-.24484	-.20030	-.02845	-.19058
PROTECT	.04979	-.07848	.07558	-.08056
REDUCE	.09451	-.19520	-.07148	.12722
RELATION	.16657	-.26457	.12200	.17362
RISKS	.14486	-.09108	.40018	-.11846
RISKY	.05187	-.02758	-.00346	.02843
SAFEACT	-.17836	.10777	-.08089	.12652
SAFEBOOK	-.04891	-.07296	-.06932	.06262
SAFEINSP	.09151	-.21503	-.12335	-.07106
SAFEREP	.09725	.06061	.16310	-.05686
SCAFFOLD	-.01957	-.00207	.14411	.00379
SENSE	.25552	.06412	-.03443	.19020
SERVICE	.05189	-.10765	-.19041	.14328
SITE	-.15576	-.12956	.02429	.00594
SKILLFUL	.27482	-.11557	-.08557	.14551
SUBCONT	-.12006	.25777	-.17662	.11288
SUPERV	-.24982	-.07942	.00803	-.12236
T_ASBEST	.12389	-.07566	-.08021	.08687
T_LIKE	.52074	-.04526	-.07024	-.08701
T_SAFETY	-.06220	.09248	-.05371	-.03770
TALK	.07391	-.05324	-.01278	.00193
TELL	-.18201	-.01649	-.01275	.11683
TIDYSITE	-.18954	-.17707	-.17373	-.05321
TOXIC	-.09060	.00285	-.16007	-.24475
TRAINING	-.33999	-.12876	.22088	.00383
WEAR	.09280	.11677	.01759	.07660
WORKMATA	-.10470	.03106	.00623	.26214

4.7.3 APPLIED FACTOR NAMES

The factor analysis generated 19 factors with eigenvalues greater than 1. These group of factors are shown in the factor matrix in Section 4.8.4 above, and portrays various levels per variable analysed. In order to give meaning to these results of factor analysis, and to relate them to the research model, it is necessary to assign identifiable names to the group of factors in each league of variables within each factor group. This is because the factors are aggregations of individual variables. The variables with co-efficient values of 0.46 and greater, are considered significant at 0.95 percent confidence level.

The dominant variables have common characteristics relating to the Organisational aspects of safety in construction. Where no dominant variable is found, then such factor is discounted in the subsequent analysis. Discussion of the results can be seen in Chapter Five below.

1. **FACTOR 1: Organisational Policy**

Dominant variables listed within this category are those with factor co-efficient value of 0.46 and above.

These are:- Believe; Committee; Equip; Operate; Plan; Protect; Safebook; SafeRep; Scaffold; Talk; Tidysite; Training; Helmet; Lessacci; Mechan; and have a score ranging from 0.46 to 0.73 - significant.

The above results reaffirm the significance, and primary influence which the identified dominant variables play in safety organisation and performance.

The results demonstrate the following:

a) BELIEVE: Where operatives believe that the company and management care much about their personal safety, they are more willing to co-operate in ways that improve safety performance in the organisation.

b) COMMITTEE: Companies with effective safety committees are more likely to take steps that improve safety performance than those companies without. This means that safety committees can play a positive role in the improvement of safety performance.

c) EQUIP: This result indicates that the provision and use of the correct type of equipment for a job, and the provision and use of safety protective clothing and equipment are a pre-requisite for improved safety performance. They should be trained in correct usage.

d) OPERATE: Companies must have a clear policy of only using trained plant operators to operate plants on site, and operatives without suitable training to operate particular plant types should have the right to refuse instructions to do so, as part of safety policy.

e) PLAN: The result indicate that sites which are properly planned, jobs are more likely to improve safety performance by reducing the causes of most accidents on site.

f) PROTECT: This result confirms the significance of operatives wearing safety protective clothing and equipment on site. It also agrees with the suggestion that operatives who refuse to wear them should be punished some how by management. The company must provide them to maintain standards, and effect usage.

g) SAFEBOOK: This result confirms the importance of providing every construction worker with a safety booklet or manual on joining a company, as company policy. It shows that a brief safety induction to every new recruit on their first day or week in a company will positively influence safety on site.

h) SAFETY REP: The result indicate that having a well trained and efficient Safety Representative on site can improve safety performance on site. This is because they can undertake fault spotting, and insist on corrective or remedial action being taken, thereby reduce factors likely to cause accidents or incidence.

i) SCAFFOLD: The result indicate that a single contractor should be responsible for scaffolding on a multi-contractor site, and that regular inspections and spot-checks are imperative for good safety performance outcome on sites. It also confirms that scaffolding erectors should be trained and that commonsense and building experience alone is not sufficient.

j) TALK: This result indicate that site managers and supervisors must engage in regular safety talks with operatives on site. It shows that sites where supervisors and managers talk regularly to operatives have better safety outcomes.

k) TIDY SITE: Operatives believe that clean and tidy sites improve safety performance, and that the opposite is equally true.

l) TRAINING: The result confirms that good training, and joint training of operatives and site supervisors are relevant to good safety awareness, and that those can lead to improved safety on site.

m) HELMET(etc): The provision of safety boots, helmet, and all safety equipment by the company is seen as significant by operatives. This result ties-up with the findings in (c) and (f) above.

n) LESSACCI: This result indicates that less accidents occur with workers who know their jobs, and think about what they are doing during the work operation. This means that the knowledge and competence of the operative of the job they do, and their thoughtfulness about safety whilst doing it can influence their personal safety performance. This result also illustrates that worker's co-operation with each other while working together can lead to less accidents. It may be that they watch out for each other in order to get the job done.

o) MECHAN: The statement that workers should not be instructed to operate mechanical plants without adequate operating and related safety training is up held by the result. This result strengthens the outcome in (l) above indicating that a sound training policy is essential to good safety performance in the industry.

2. FACTOR 2: Supervision and Equipment Mismanagement:

Dominant variables under this category include the following: Erector; Mechan; and SuperV. They have values of co-efficient ranging from 0.46 to 0.58 respectively (see table below).

a) ERECTOR: The result refutes the suggestion that "steel-erectors do not need training to become one". Again, this outcome confirms the findings in (d), (i) and (l) above.

b) MECHAN: This result has an inverse value of .58 which means that unsuitable and defective mechanical plants on site use are a recipe for safety disaster on site, as they can lead to accidents or incidence on site. This result is relative to the result described in (o) above.

c) SUPERV: This result indicates that supervisors positive safety behaviour on site can influence operative safety attitudes. Because the supervisor is careful about safety, it signals to the operative that the supervisor is serious about safety on site, and that they are not likely to tolerate unsafe actions, or behaviour.

3. **FACTOR 3: Industry Norms**

Dominant variables which fall within this league are: Age; Blindeye and Industry, and have coefficient values of 0.466 to 0.539 (see table)

a) AGE: The result indicate that the older the worker, the less risks they are likely to take in the workplace.

b) BLINDEYE: This result has a coefficient value of 0.51, and indicates that supervisors are more likely to turn a blindeye to worker's taking unsafe chances in job where productivity bonus are offered. This may be due to the pressure to achieve or meet performance targets set by agreed programmes.

c) INDUSTRY: This result have a co-efficient value of 0.47 and therefore significant. This result indicates that the nature of the industry itself generates its own form of risks which must be taken into account in design, construction and training programmes.

4. **FACTOR 4: REWARD**

The variables found to be dominant in this league are: Bonus; Industry; Service; and Age; and have values of co-efficient ranging from 0.48 to 0.61.

Whilst industry, service and age have positive influences and are related to each other in terms of familiarity with the industry processes, Bonus has inverse value. Bonus here refers to safety bonus as opposed to productivity incentive bonus.

The result shows that payment of specified safety bonus will influence operatives to work more safely in order to get it, whilst productivity bonus leads to some risks being taken by faster working methods than working at their usual pace and care.

On the other hand, the older an operative, and the longer time spent in the industry, the more likely such an operative may adopt safer working methods. This is provided valuable experience and safety training have been regular throughout.

5. **FACTOR 5: Management Behaviour**

Leadership by example is the only primary and dominant variable in this group of factors.

The result of 0.50 co-efficient value indicate that where managers and supervisors display strong and positive safety leadership by good example, the operatives are more likely to follow suit, and attempt to work safer as their leader.

6. **FACTOR 6: Occupation**

This outcome demonstrates that the nature of the job done has a dominant influence. It indicates that most accidents on site can be avoided if workers understand their jobs, and by being a little more careful and observant about what they are doing on site.

8. **FACTOR 8: TOXIC**

Failure to provide suitable and adequate protection against exposure to asbestos, and other toxic substances on site is seen as a significant variable in safety. The result has a co-efficient value of 0.50 and is dominant.

9. **FACTOR 9: Qualities**

Personal carefulness and having the right skills for the job in hand is indicated to be a dominant factor of influence in safety.

The result shows that the more skilful and careful a worker is about the job in hand, the less likely they are to have an accident initiated by their actions.

11. **FACTOR 11: MATERIALS**

SEE (8) ABOVE.

16. **FACTOR 16: LIKE**

This result indicates that likeness of the job in hand is a dominant variable. It means that if a person likes the job they are doing, they take more interest, and are more careful whilst doing it. Coefficient value 0.52.

19. **FACTOR 19: MONEY**

This result indicates that payment systems, and the value of financial earnings are dominant variables.

If money is paid as an incentive to increase productivity, and meet deadlines, then it produces the likelihood of accelerated safety performance. On the other hand payment of safety bonus has an opposite influence.

Others variables in factors 10, 12, 13, 14, 15 and 17 were found to be redundant and as such were discounted from analysis.

This means these variables have very little or no influence to safety performance.

Detailed discussion of the results and their implications are discussed in Chapter 5.

Below shows a summary of the factors and their significant constituents in descending order:

POLICY	SUPERVIS	NORMS	REWARD	MANAGEMT	OCCUPATN	TOXIC	QUALITY	MATERIAL	LIKE	MONEY
Talk	Mechan	Age	Service	Examples	Jobs	Toxic	Careful	T_asbest	T_like	Money
Safebook	Erector	Blindeye	Bonus				Skilful			
Equip	Superv	Industry	Industry							
Tidysite			Age							
Protect										
Saferep										
Believe										
Operate										
Plan										
Commitee										
Scaffold										
Training										
Helmet										
Lessacci										
Mechan										

TABLES 4.7 SUMMARY OF FACTORS AND THEIR CONSTITUENT VARIABLES

4.7.4 MULTIPLE REGRESSION

Two standard multiple regression analyses were performed in the study. The first analysis involves examining linear relationship between the composite safety performance factor,*T_PERFOR*, as the dependent variable and the 11 composite safety attitude factors described earlier as independent variables. The second analysis attempts to investigate possible linear relationship between the severity of accidents, *HOWMUCH*, as the dependent variable and the other 11 composite safety attitude factors as independent variables. The analysis was carried out using linear multiple regression technique available in SPSS for Windows.

Safety Performance

The result of the regression analysis between the accident rate variable and the 19 safety attitude factors is shown below:

Multiple R	.35346
R Square	.12493
Adjusted R Square	.04050
Standard Error	5.22392

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	444.15134	40.37739
Residual	114	3110.98750	27.28936

F = 1.47960 Signif F = .1486

Variable	B	SE B	95% Confdnce	Intrvl B	Beta
POLICY	-.002728	.133524	-.267238	.261782	-.002111
LIKE	-1.819634	1.842885	-5.470376	1.831108	-.090896
MONEY	.605771	.877995	-1.133530	2.345073	.066239
SUPERVISION	-.262377	.467100	-1.187699	.662945	-.053656
NORMS	-.875657	.375781	-1.620077	-.131238	-.371757
REWARD	.455048	.295112	-.129566	1.039662	.249610
MANAGEMENT	.332635	1.042414	-1.732380	2.397649	.030146
OCCUPATION	1.651785	.964747	-.259372	3.562941	.160940
TOXIC	.326589	.900705	-1.457700	2.110878	.032558
QUALIFIES	-1.139033	.585871	-2.299639	.021573	-.183065
MATERIALS	.210828	1.385077	-2.532999	2.954656	.013794
(Constant)	27.218906	4.623302	18.060179	36.377632	

Severity of Accidents

A linear multiple regression analysis was performed to investigate the influence of safety attitudes towards the severity of accidents and the results are shown below:

Multiple R	.30861
R Square	.09524
Adjusted R Square	.00794
Standard Error	1.26666

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	19.25341	1.75031
Residual	114	182.90532	1.60443

F = 1.09092 Signif F = .3749

Variable	B	SE B	95% Confdnce	Intrvl B	Beta
POLICY	-.051548	.032376	-.115684	.012589	-.167300
LIKE	-.137717	.446851	-1.022924	.747491	-.028849
MONEY	.075393	.212890	-.346341	.497128	.034572
SUPERVISION	.100133	.113259	-.124233	.324499	.085872
NORMS	-.092452	.091117	-.272954	.088050	-.164598
REWARD	.034914	.071557	-.106839	.176667	.080313
MANAGEMENT	.246188	.252758	-.254523	.746899	.093564
OCCUPATION	.335423	.233925	-.127981	.798828	.137052
TOXIC	.209668	.218397	-.222975	.642310	.087655
QUALIFIES	.231821	.142058	-.049595	.513237	.156245
MATERIALS	-.328102	.335844	-.993407	.337204	-.090023
(Constant)	.516425	1.121028	-1.704323	2.737172	

Outliers and Influential Data Points

The Mahalanobis' distances, Cook's distances and leverages of data points are shown in the Appendix. No outliers were detected (Mahalanobis' distance < 38.21) and Cook's distance and leverages are small (< 0.17 and < 0.31 respectively). Thus no cases were required to be deleted prior to the analyses.

Residual Plots

Residual plots of the analyses have been included in the Appendix for examination of potential problems with the regression model. The data points in the two plots appear to be random and do not show any form of heteroscedasticity. The results therefore do not violate assumptions of multiple regression.

4.7.5 INTERPRETATION OF MULTIPLE REGRESSION

Safety Performance

A standard multiple regression analysis was conducted satisfactorily with over 95% confidence indicated by the R-square value of 0.125. As a consequence, the result of the linear regression was significant in estimating a linear relationship between the transformed safety performance variables and the 11 factors obtained from the previous factor analysis.

The relationship derived using SPSS is as follows:

$$T\_PERFOR = 27.2189 - 0.0027POLICY - 1.8196LIKE + 0.6058MONEY - 0.2623SUPERVIS - 0.8757NORMS + 0.4550REWARD + 0.3326MANAGEMT + 1.6518OCCUPATN + 0.3266TOXIC - 1.1390QUALITY + 0.2108MATERIAL$$

Using hypothesis (H_0) testing of coefficient of variables, the 95% confidence interval indicates a weak result in certain factors. For any confidence interval of factor containing zero, an insignificant contribution to the equation can be interpreted. By discounting all factors with such coefficient, we obtain the following equation:

	T_PERFOR =	27.2189	-	0.8757 *NORMS*
95%	Lower:	18.0602		-1.6200
Confidence limits	Upper:	36.3776		-0.1312

From the above equation a linear relationship between Industry Norm and Safety Performance has been deduced. The above equation also indicates 95% confidence of the variable coefficient, and the constant in the equation. By substituting the original variables into the factor of Industry Norm, we can obtain a further equation in terms of AGE, BLINDEYE (payment system, e.g., effect of bonus) and INDUSTRY.

$$\begin{aligned} T\_PERFOR &= 27.2189 - 0.8757\,NORMS \\ &= 27.2189 - 0.8757(0.5390\,AGE + 0.5096\,BLINDEYE + 0.4656\,INDUSTRY) \\ \therefore \quad &= 27.2189 - 0.4712\,AGE - 0.4462\,BLINDEYE - 0.4077\,INDUSTRY \end{aligned}$$

4.7.6 SEVERITY OF ACCIDENTS

The results of the standard multiple regression did not confirm a linear relationship between the severity of accidents and the eleven factors. The R-square value obtained from the analysis indicate a less than 95% confidence in the results (R-square < 0.1). Consequently, the coefficients obtained in the analysis are not sufficiently reliable to conclude a linear relationship between the factors and the severity of accidents.

As a result of the above findings in the further analysis. the research model has to be revised to reflect the inherent structure of the influences upon safety performance. A revised model is shown in the discussion chapter followed.

4.8 C2 - COMPARISON OF BEHAVIOURAL PATTERNS (ATTITUDES) SITE MANAGERS, CONTRACT MANAGERS AND SAFETY ADVISERS/MANAGERS : TEST OF SIGNIFICANCE

As section 4.6 above, this section reports the patterns of behaviour of site managers, contract managers and safety advisers/managers. It investigates the differences in patterns of behaviour irrespective of variables contained in the model, (see Figure 3.8 & Figure 4.5 above), and compares the three parties mentioned.

The measurement statistics used were the chi-square test of significance, and the results are in Appendix M/1 - M/12, and discussed below.

4.8.1 Main Sub-Hypothesis 'C' : $C1_2 = C2_1 = C2_3 = C2_3$ Attitudes of Site Managers towards behavioural and environmental (variables) Factors differ from those of Contract Managers and Safety Advisers/Managers

Null hypothesis 14.1 : There is no historical difference in attitudes between site managers, contract managers and safety advisers/manager - C3 vs C2 - (a, b & c).

An examination of management data showed similar results to those of the operatives and site managers, which leads to the conclusion that no differences exist between site managers, contract managers, and safety managers as regards historical variables of age, occupation, experience and training as far as their impact on safety performance was concerned (see Null-hypothesis 1.1 and 8.1 Sections 4.5.1 and 4.6.1 above).

Null-hypothesis 14.2 : There is no economic difference in attitudes between site managers, contract manager and safety advisers etc (see Appendix M/1 & M/2).

(a) An examination of the results of chi-square tests showed the following outcome:

Differences exist between site managers' attitudes and those of contract managers and safety advisers, towards the statement that 'bonus schemes influence safety organisation on site'.

The result showed site managers' support for the argument that 'bonus systems influence safety organisation on site' (χ^2 = 0.09, p = not significant - see Tables in Appendix M/1).

On the other hand, both contract managers and safety advisers rejected the argument (Contract Managers χ^2 = 5.44, and safety advisers χ^2 = 8.30, both significant - see Tables in Appendix M) - the attitudes of Site Managers is different to those of Contract Managers and Safety Advisers.

It is of some concern that whilst operatives and site managers share similar views about the likely impact of bonus systems on safety performance, this opinion was not shared by contract managers and safety advisers responsible for safety policy.

The explanation may be found in the distance between those involved in the day-to-day site environment, and thus experiencing the productivity incentive issues (operatives and site managers), and those not directly involved with those on site, i.e. contract managers and safety advisers).

(b) Chi-square tests showed total support for the view that 'injury related accidents affect productivity and financial performance - see below:

(i) Site Manager: χ^2 = 0.31 - not significant;
(ii) Contract Managers: χ^2 = 2.93 - " "
(iii) Safety Advisers: χ^2 = 2.86 - " "

(See tables in Appendix M/1 (2).

that is: S.M. = C.M. = Safety Ad = No difference.

This result is not surprising due to the factual nature of the suggestion. It is therefore the only logical outcome in this case.

(c) The view that 'bonus systems lead to supervisors turning a 'blind eye' to safety hazards on site' was supported again by site managers, but rejected by contract managers, and safety advisers. This indicates a difference in attitudes between site managers and contract managers and safety advisers.

Again explanations given in (a) above may also apply here. (see Table 3 in Appendix M/1. S.M. difference in attitudes to C.M. and S.Ads.)

(d) Chi-square tests showed agreement between contract managers, and safety advisers in opposing the view that 'more safety training leads to better safety standards'.

This view was supported by site managers (see Tables where S.M. $= \chi^2 = 1.62$, - not significant; C.M. $= \chi^2 = 7.58$ - significant; and safety advisers $= \chi^2 = 7.53$ - significant - (see Table 2 in Appendix M/1) - S.M. is different in attitude to C.M. and Safety Advisers.

(e) The view that 'need to achieve commercial advantage or profits at tender influenced site safety organisation' was again supported by site managers, and rejected by contract managers, and safety advisers - (see results of chi-square tests in Table 5 in Appendix M/1, where S.M. $= \chi^2 = 2.79$ - not significant; C.M. $= \chi^2 = 4.92$ - significant; safety advisers $= \chi^2$ 15.32 - very significant). S.M. different in attitude to C.M. and S.A.

(f) The results of statistical analysis showed site managers supported the argument that 'A' percentage of safety provision on job cost allowed in tender sums would improve safety arrangements on site. However, this view was not supported by contract managers or safety advisers (see Table 6 in Appendix M/1; where S.M. $= \chi^2 = 1.28$ - not significant; C.M. $= \chi^2 = 5.09$ - significant and safety advisers $\chi^2 = 5.09$ - significant) - S.M. is different in attitude to C.M. and S.Ads.

Again contract managers and safety advisers have similar attitudes but opposite to those of site managers.

(g) Chi-square tests again confirm site managers' support for the view that 'client's contribution to the enforcement of safety provisions in tenders will improve safety organisation on site'.

Similarly, the above view was equally rejected by contract managers and safety advisers (see Tables 7 in Appendix M/2). Where S.M. - χ^2 = 0.76 - not significant, C.M. - χ^2 = 4.45 - significant and safety advisers - χ^2 = 4.51 - significant).

There is a difference in attitude between site managers on the one hand, and contract managers and safety advisers on the other.

(h) Statistical tests indicated unanimous support by all three groups (S.M., C.M. and S.A.) for the argument that 'contractor compliance with contract safety provision promotes better safety performance' (see Table 8 in Appendix M/2; where S.M. - χ^2 = 8.00 - significant; C.M. - χ^2 = 8.25 - significant; and safety advisers - χ^2 = 12.71 - very significant), indicating no difference in attitudes.

This is a very logical result since contract conditions play a significantly dominant role in all construction matters. However, contract provision must be capable of being enforced in order to be effective on all parties to the contract.

(i) Chi-square tests showed total agreement by all three groups with the suggestion that 'workers' safety consciousness on site influences productivity targets', and thus concluding that S.M. = C.M. = S.A. (see Table 9 in Appendix M/2; where S.M. - χ^2 = 0.25 - not significant, and safety advisers (S.A.) - χ^2 = 1.54 - not significant). This showed no difference in attitudes.

(j) Chi-square tests again showed total agreement by the group towards the argument that 'awarding safety bonus lead to improved safety performance' and thus S.M. = C.M. = S.A. (see Table 10 in Appendix M/2; where S.M. - χ^2 = 1.87 - not significant; C.M. - χ^2 = 0.73 - not significant, and S.A. - χ^2 = 1.90 - not significant). This showed no difference in attitudes.

Null-hypothesis 14.3 : There is no psychological difference in the attitudes between site managers, contract managers, and safety advisers etc.

(a) Statistical tests showed total agreement with the argument 'individual safety awareness improves safety performance on site' and thus support the null hypothesis (see Table 11 in Appendix M/3; where S.M. - χ^2 = 1.31 - not significant; C.M. - χ^2 = 0.00 - not significant, an S.A. - χ^2 = 1.67 - not significant).

(b) Chi-square tests showed total agreement with the statement that 'workers' irresponsible site behaviour undermines safety performance on site'. This unanimous result indicates support for the null hypothesis (see Table 12 in Appendix M/3; where S.M. - χ^2 = 0.00 - not significant; C.M. - χ^2 = 0.40 - not significant, and S.A. - χ^2 = 0.54 - not significant).

(c) Chi-square tests showed differences in attitudes between site managers on the one hand, and contract managers and safety advisers on the other, towards the opinion that 'workers' perception of the building industry as tough and dangerous influences 'macho' behaviour and risk-taking'.

Again there is general agreement between operatives and site managers, but which is apposite to those of contract managers and safety advisers, see Pirani (1976) and Leather (1987) etc and Table 13 in Appendix M/3; where S.M. - χ^2 = 5.32 - significant; C.M. - χ^2 = 2.37 - not significant, and S.A. - χ^2 = 2.36 - not significant).

(d) Results of chi-square showed unanimous agreement with the opinion that 'pressure to achieve programme and lack of safety up-dates undermines safety on site' (see Table 14 in Appendix M/3; where S.M. - χ^2 = 10.01 - significant, C.M. - χ^2 = 5.60 - significant, and S.A. - χ^2 = 11.35 - significant.

This result indicates total support for the null-hypothesis that 'there is no difference in attitude between site managers, contract managers, and safety advisers towards psychological variables - (see Figure 4.5 above).

(e) Safety is mostly a matter of commonsense. Chi-square test indicated that there was agreement between site managers an safety advisers and a differing of opinion with contract managers (see Table 15 in Appendix M/3; where S.M. - χ^2 = 4.32 - significant; S.A. - χ^2 = 10.08 - significant; contract managers - χ^2 = 0.82 - not significant).

The above opinion was strongly voice by operatives, site managers and safety advisers during the pilot interviews. It is therefore not surprising that the view was confirmed by the statistical analysis. Any difference would have meant a role of chance at play as a normal occurrence when a large sample such as this one is subjected to statistical analysis.

(f) The view that 'individual carelessness is responsible for most accidents on site' was showed by chi-square test to be agreeable to site managers and safety advisers, but not to contract managers (see Table 16, in Appendix M/3; where S.M. - χ^2 = 9.09 - significant; contract managers - χ^2 = 0.00 - not significant, and safety advisers - χ^2 = 13.67 - very significant) - again indicating differentiation of attitudes.

(g) Chi-square tests showed total agreement between the group towards the opinion that 'urgency to achieve programme timescales forces site managers to pay less attention to safety on site (see Table 17 in Appendix M/4 where S.M. - χ^2 = 16.73 - significant; C.M. - χ^2 = 4.14 - just significant, and safety advisers - χ^2 = 16.89 - significant).

This result indicated no difference in attitudes and supports the null-hypothesis.

(h) Chi-square test showed that differences in attitudes existed between site managers and safety advisers on the one hand, and contract managers on the other, towards the statement that 'construction team co-operation on site influences accident reduction'.

This result again indicated closer similarities in attitudes between site manager and safety advisers than with contract managers and safety advisers.

The explanation for this occurrence may be that site managers interact more closely with safety advisers than with contract managers, and have much closer involvement with safety issues affecting the site environment, than with contract managers (refer table 18 in Appendix M/4; where S.M. - χ^2 = advisers - χ^2 = 35.69 - highly significant).

The result reject the null hypothesis.

(i) Chi-square test indicated general agreement that 'site management safety behaviour on site is a major influence on workers' safety behaviour on site' (see Table 19 in Appendix M/3; where S.M. - χ^2 = 2.32 - not significant; C.M. - χ^2 = 1.03 - not significant; S.A. -χ^2 = 2.52 - not significant.

This indicates no difference in attitude between the group and supports the null hypothesis.

(j) Chi-square test showed that site managers' attitudes differ from those of contract managers and safety advisers in respect of the statement that 'poor co-operation between sub-contractors on site undermines safety' (see Table 20 in Appendix M/4; where S.M. - χ^2 = 0.60 - not significant; C.M. - χ^2 = 4.08 - not significant; S.A. - χ^2 = 3.91 - just significant.

The result supports the null-hypothesis. This outcome is consistent with the findings of Apau (1980) see reference.

<u>Null-hypothesis 14.4 : There is no procedural difference in the attitudes between site managers, contract managers and safety advisers etc.</u>

(a) Investigating near-accidents was identified by the pilot survey for the research as a means of preventing future or potential accidents. As a result the proposal that 'investigating near-accidents leads to prevention of future accidents', was made to test the group's feelings about the statement.

Chi-square tests showed agreement to the statement by site managers and safety advisers. Again, contract managers indicated a difference in attitudes (see Table 21 in Appendix M/5; where site managers - χ^2 = 3.51 - moderately significant; control managers - χ^2 = 1.82 - not significant; safety advisers - χ^2 = 10.82 - significant.

The result therefore showed a difference existing between contract managers, site managers and safety managers, it hence rejects the null-hypothesis.

(b) Chi-square tests showed no difference in attitudes between the management group towards the statement that 'considering safety procedures at tender stage is unnecessary' (see Table 22 in Appendix M/5; where site managers - χ^2 = 0.08 - not significant; contract managers - χ^2 = 1.91 - not significant; safety answers - χ^2 = 2.32 - not significant).

This result supports the null-hypothesis.

(c) Statistical tests indicated no differences to exist in attitudes between site managers and contract managers and safety advisers in respect of beliefs that 'the provision of protective safety clothing etc. by firms is necessary to improve safety standards on site'.

This is the opinion of the group as indicated by chi-square test results as follows:

Site managers - χ^2 = 0.70 - not significant;
Contract managers - χ^2 = 1.91 - not significant;
Safety advisers - χ^2 = 1.96 - not significant (see Table 23 in Appendix M/5).

(d) Chi-square tests showed differences in site managers attitudes to those of contract managers and safety advisers, in respect of the argument that 'considering safety procedures and work methods at tender improves safety performance' (see Tables 24 in Appendix M/5; where site managers - χ^2 = 0.09 - not significant, contract managers - χ^2 = 9.14 - significant; safety advisers - χ^2 = 9.28 - significant).

(e) Chi-square tests indicated no differences in attitudes between site managers, contract managers and safety advisers in respect of the argument that 'providing all employees with safety manuals or booklets improved safety performance'.

The results showed unanimous support for the null-hypothesis (see Tables 25 in Appendix M/5, where: site managers - χ^2 = 6.72 - significant; contract managers - χ^2 = 30.29 - very significant; safety advisers - χ^2 = 196.87 - highly significant.

Null-hypothesis 14.5 : There is no technical difference in attitudes between site managers, contract managers and safety advisers etc

(a) Results of chi-square test indicated no difference between site managers attitudes and those of contract managers an safety advisers towards the statement that 'workers should be discouraged from operating mobile plant and equipment for which they have received no training'.

This result supports the null-hypothesis of no difference in attitudes between members of the three management groups (see Table 26 in Appendix M/6; where: site managers - $\chi^2 = 0.36$ - not significant; contract managers - $\chi^2 = 1.42$ - not significant; safety advisers - $\chi^2 = 1.42$ - not significant.

However, contract managers' attitudes are closer in this case to those of safety advisers than site managers, as chi-square test x2 for both = 1.42 - not significant.

(b) There is general agreement between site managers and contract managers to the statement that 'provision of safety information to workers is lacking in the construction industry, but safety advisers differed (see chi-square tests in Table 27 in Appendix M/6; where: Site Managers - $\chi^2 = 1.66$ - not significant; contract managers - $\chi^2 = 0.12$ - not significant; safety advisers - $\chi^2 = 3.19$ - significant.

This result indicates that differences in attitudes exist and therefore rejects the null-hypothesis.

(c) Chi-square test showed unanimity towards the argument presented that 'the training of contract managers in health and safety is inadequate for effective safety administration' (see Table 28 in Appendix M/6; where Site Managers - $\chi^2 = 0.04$ - not significant; contract managers - $\chi^2 = 0.73$ - not significant, and safety advisers - $\chi^2 = 1.34$ - not significant).

(d) Difference exists between site managers' attitudes to the statement that 'wearing protective safety clothing and equipment reduces workers' efficiency on site' and those of contract managers and safety advisers' (see Table 29 in Appendix M/6; where site managers - $\chi^2 = 0.58$ - not significant; contract managers - $\chi^2 = 4.91$ - significant; safety advisers - $\chi^2 = 9.52$ - significant).

This result rejects the null-hypothesis.

(e) Chi-square test indicated total agreement to the suggestion that 'present methods of tendering discriminate strongly against more safety-conscious contractors (see Table 30 in Appendix M/6; showing chi-square χ^2 for site managers = 1.03 - not significant; contract managers = 0.37 - not significant, and safety advisers = 2.87 - not significant. The result supports the null-hypothesis).

(f) Result of chi-square showed general agreement for the argument that 'pressure of work and fatigue leads to accidents on site' (see Table 31 in Appendix M/6; where χ^2 = site managers = 9.99 - significant; contract managers = 4.95 - significant; safety advisers = 7.47 - significant).

The results support the null-hypothesis that there is no difference in attitudes between site managers and those of contract managers and safety advisors towards technical variables: S.M. = C.M. = S.A.

Null-hypothesis 14.6: There is no organisational difference in attitudes between site managers, and those of contract managers and safety advisers etc.

(a) Chi-square test showed difference to exist in attitudes of site managers to those of contract managers and safety advisers in respect of the argument that 'more accidents occur when worker-management relationships are bad'.

The result indicated that site managers - χ^2 = 0.21 - not significant, whereas those of: contract manager - χ^2 = 5.07 - significant; safety advertisers - χ^2 = 8.62 - significant (see Table 32 in Appendix M/7). This rejects the null-hypothesis.

(b) The result of chi-square test showed that site managers and contract managers are different in attitude to safety advisers in respect of the argument that 'Trade Union involvement in safety reduces accidents on site' (see Table 33 in Appendix M/7), where chi-square χ^2 for: site managers = 2.62 - not significant; contract managers = 1.75 - not significant, but safety advisers = 9.06 - significant; thereby rejecting the null-hypothesis.

(c) The result of chi-square test showed total agreement between the groups with the statement that 'having safety representatives on site improves safety standards and performance' (see Table 34 in Appendix M/7), where χ^2 for: site managers = 0.31 - not significant; contract managers = 0.56 - not significant; safety advisers = 1.80 - not significant, and thereby supporting the null-hypothesis.

(d) The result of chi-square test showed total support to exist between the groups towards the statement that 'site managers and safety representatives have responsibility for safety on site' (see Table 35 in Appendix M/7), where χ^2 for: site managers = 3.66 - just significant; contract managers = 44.08 - highly significant; safety advisers = 7.45 - significant, and supports the null-hypothesis.

(e) The result of chi-square test showed no difference exists between the groups relating to the statement that 'management and workers' co-operation highly essential for safe working'. (see Table 36 in Appendix M/7); where χ^2 for: site managers = 1.79 - not significant; contract managers = 0.00 - not significant; safety advisers = 2.99 - not significant, and hence support the null-hypothesis.

(f) The result of chi-square test showed that there is a difference in attitude between site managers and contract managers and safety advisers regarding managers and supervisors who do not talk enough about safety to their workers (see Table 37 in Appendix M/7); where chi-square χ^2 for: site managers = 0.06 - not significant; contract managers = 6.39 - significant; safety advisers = 8.75 - significant, and thus rejected the null-hypothesis.

(g) The result of chi-square test showed that no difference in attitudes exist between site managers, contract managers and safety advisers regarding "having safety committees improves safety standards of an organisation. (see Table 38 in Appendix M/8); where chi-square χ^2 for: site managers = 4.81 - significant; contract managers = 6.02 - significant; safety advisers = 7.63 - significant, and supports the null hypothesis.

(h) The result of chi-square test showed that there is a difference in attitudes between site managers and safety advisers and some contract managers regarding the statement that 'more Factory Inspectors in the Building Industry can improve Health and Safety performance' (see Table 39 in Appendix M/8); where χ^2 for: site managers = 18.75 - very significant; safety advisers = 31.14 - very significant, and contract managers = 0.88 -not significant, and so rejects the null-hypothesis.

(i) The result of chi-square test showed that no difference in attitudes exist between the groups towards the statement that 'management attitudes determine workers' safety behaviour on site' (see Table 40 in Appendix M/8); where chi-square χ^2 for: site managers = 3.66 - just significant; contract managers = 4.51 - just significant and safety advisers = 6.11 - significant, thus supporting the null-hypothesis.

(j) The result of chi-square test showed differences in attitudes exist between the group towards the statement 'poor co-ordination of sub-contractors' work on site influences safety performance on site' (see Table 41 in Appendix M/8); where chi-squareχ^2 for: site managers = 1.37 - not significant; contract managers = 0.73 - not significant and safety advisers = 9.87 - significant, and therefore rejects the null-hypothesis.

Null-hypothesis 14.7 : There is no Environmental difference in attitudes between site managers, contract managers and safety advisers etc.

(a) The result of chi-square test showed that no differences in attitude exist between the groups regarding the statement that 'a single-contractor responsibility for all scaffolding on a site is important for the improvement of safety standards/performance' (see Table 42 in Appendix M/9); where χ^2 for: site managers = 0.25 - not significant; contract managers = 0.00 - not significant; safety advisers = 0.34 - not significant and so supports the null-hypothesis.

(b) The result of chi-square test showed that no differences in attitudes exist between the groups towards the statement that 'untidy building sites do not lead to accident occurrence' (see Table 43 in Appendix M/9); where χ^2 for: site managers = 0.03 - not significant; contract managers = 2.75 - not significant; safety advisers = 2.85 - not significant, and supports the null-hypothesis.

(c) The result of chi-square test showed that differences in attitudes exist between site managers and contract managers to those of safety advisers, towards the proposition that 'providing good quality welfare and first-aid facilities on site improves safety standards' (see Table 44 in Appendix M/9); where chi-square χ^2 for: site managers = 0.96 - not significant; contract managers = 2.50 - not significant, and safety advisers = 6.48 - significant, thus rejecting the null-hypothesis.

(d) Chi-square test again showed that differences in attitudes exist between site managers and contract managers and safety advisers in respect of the statement that 'providing workers' thermal or warm clothing in winter can lead to accident reduction on site' (see Table 45 in Appendix M/9); where chi-square χ^2 for: site managers = 1.16 - not significant; contract managers = 0.95 - not significant and safety advisers = 4.43 - just significant; thus rejects the null hypothesis.

(e) Chi-square test showed that differences in attitudes exist between site managers, contract managers and safety advisers in respect of the statement that 'good job planning and site organisation improves safety performance' (see Table 46 in Appendix m/9) where chi-square result χ^2 for: site managers = 0.15 - not significant; contract managers = 4.73 - significant and safety advisers = 6.26 - significant thus it rejects the null hypothesis.

(f) Chi-square test showed that differences in attitudes exist between site managers and safety advisers from those of contract managers in respect of the statement that 'an inadequate supply of the right type an quality of tools, plant and equipment, leads to accidents and damage on sites', (see Table 47 in Appendix M/9), where chi-square result χ^2 for: site managers = 3.00 - just significant; safety advisers = 3.82 - just significant and contract managers = 0.17 - not significant.

(g) Chi-square test showed no difference in attitudes between the group in respect of the statement that 'attitudes of older workmates to safety and health are a source of major influence to new recruits in the construction industry' (see Table 48 in Appendix M/10), where chi-square χ^2 for: site managers = 2.21 - not significant; contract managers = 0.29 - not significant and safety advisers = 2.38 - not significant. Thus it supports the null hypothesis.

(h) Chi-square test showed that differences in attitudes exist between site managers and those of contract managers and safety advisers in respect of the statement that 'inadequate control and supervision of workers on site is a major factor in accident occurrence', (see Table 49 in Appendix M/10), where chi-square result χ^2 for: site managers = 0.00 - not significant; contract managers = 4.13 - significant and safety advisers = 4.79 - significant, thus rejecting the null hypothesis.

(i) Chi-square test showed that no differences in attitudes exist between the groups, in respect of the statement that 'workers and managers can reduce the causes of most accidents on site by being a little more thoughtful about safety provisions on site' (see Table 49 in Appendix M/10), where chi-square χ^2 for: site managers = 7.24 - significant; contract managers = 9.10 - significant; safety advisers = 13.91 - significant, and thus it supports the null hypothesis.

Null-hypothesis 14.8 : There is no difference in attitudes between site managers, contract managers, and safety advisers, towards safety performance factors (variables)

(a) Chi-square test showed that differences in attitudes exist between site managers, an those of contract managers and safety advisers, in respect of the statement that 'regular safety assessments on a competitive basis increases safety awareness' (see Table 51 in Appendix M/11), where chi-square result is χ^2 for: site managers = 1.38 - not significant; contract managers = 5.99 - significant; safety advisers = 5.97 - significant, and thus it rejects the null hypothesis.

(b) Chi-square test again showed that differences in attitudes exist between site managers and those of contract managers and safety advisers, in respect of the statement that 'the Health and Safety Inspectorate have inadequate resources to enforce safety requirements in the construction industry' (see Table 52 in Appendix M/11); where chi-square result χ^2 for: site managers = 0.01 - not significant; contract managers = 4.95 - significant; and safety advisers = 6.30 - significant, and thus it rejects the null hypothesis.

(c) Chi-square test showed that no differences exist in attitudes between the groups in respect of the statement that 'hazard identification, analysis an up-dating by management would lead to improved safety performance on site (see Table 53 in Appendix M/11); where χ^2 for: site managers = 7.24 - significant; contract managers = 4.07 - significant; safety advisers = 8.73 - significant, and hence supports the null hypothesis.

(d) Chi-square test showed again that no differences exist in attitudes between the groups in respect of the statement that 'efficient hazard identification and analysis as a key management function is a key factor in encouraging improved safety performance' (see Table 54 in Appendix M/11); where chi-square χ^2 for: site managers = 7.84 - significant; contract managers = 9.64 - significant, and safety advisers = 13.39 - significant, which thus supports the null hypothesis.

(e) Chi-square test showed that differences in attitudes exist between site managers and safety advisers and those of contract managers, in respect of the statement that 'displaying all accident information on site would prevent risk-taking by workers' (see Table 55 in Appendix M/11), where chi-square result χ^2 for: site managers = 7.08 - significant; safety advisers = 9.38 - significant, and contract managers = 0.00 - not significant, and thus rejects the null hypothesis.

(f) Chi-square test showed no differences exist in attitudes between the groups in respect of the statement that 'alcohol and drugs are not major problems for safety on site' (see Table 56 in Appendix M/11); where χ^2 for: site managers = 0.04 - not significant, contract managers = 0.08 - not significant and safety advisers = 0.26 - not significant, and thus supports the null hypothesis.

(g) Chi-square test showed that differences in attitudes exist between site managers, and those of contract managers and safety advisers in respect of the statement that 'all companies in the building industry should have alcohol and drugs policies as part of safety policies' (see Table 57, Appendix M/12), where χ^2 for: site managers = 0.06 - not significant; contract managers = 3.98 - just significant; safety advisers = 4.53 - significant; and thus rejects the null hypothesis.

(h) Chi-square test showed that no differences in attitudes exist between site managers, contract managers and safety advisers towards the statement that 'lack of consultation between clients, engineers, designers, managing contractors and sub-contractors, undermines safety provision, and safety performance of contract' (see Table 58 in Appendix M/12), where chi-square result χ^2 for: site managers = 6.00 - significant; contract managers = 12.76 - very significant; safety advisers = 31.64 - highly significant, and hence support the null hypothesis.

(i) Chi-square test showed that differences in attitudes exist between contract managers, and those of site managers, and safety advisers in respect of the statement that 'safety provision in tender documents are too vague for promoting better safety on site' (see Table 59 in Appendix M/12); where chi-square χ^2 for: site managers = 2.25 - not significant; contract managers = 0.13 - not significant; safety advisers = 4.19 - significant, and hence rejects the null hypothesis.

(j) Chi-square test showed that differences in attitudes again exist between site managers, contract managers, and safety advisers in respect of the statement that 'most accidents occur on multi-occupied sites due to inadequate control of sub-contractors' (see Table 60 in Appendix M/12); where chi-square result χ^2 for: site managers = 2.25 - not significant; contract managers = 0.13 - not significant and safety advisers = 4.19 - significant, and thus rejects the null hypothesis.

4.8a <u>Conclusions of Sub-hypothesis C (C2a = C2b = C2c) : Site Managers' Attitudes towards behavioural and environmental variables differ from those of contract managers and safety advisers</u>

The previous statistical analysis for hypothesis B above examined the differences between operatives and site managers' attitudes towards behavioural and environmental variables as shown in the research model in Figure 3.8 above, and found similarities to exist between most of the variables compared, using the chi-square test of significance as sole measure or test (see Section 4.6 above).

Similarly, this section (4.8) examined the difference between site managers' attitudes towards behavioural, environmental and safety performance variables compared to those of contract managers and safety advisers.

The aim of this comparison was to see if differences existed between their individual group attitudes and what impact such differences may have had upon the variables examined.

The results of the analysis using chi-square test of significance (χ^2) are detailed in the Appendix of this study, and discussed in section 4.8 above. An examination of the results indicated that predominant similarities existed between the attitudes of site managers, contract managers and safety advisers towards the variables as discussed in Chapter Three above. However, it showed that differentiation of attitudes between the groups also existed towards certain behavioural, environmental and safety performance variables, but only to a lesser degree (see discussions above in 4.8).

Where similarities existed, the results indicated total and unanimous support for the tested variables.

A summary of the variables examined for attitudinal comparisons are as follows:

(a) Site managers believed that economic and environmental factors had a major impact on safety on site - more so than the rest of the variables (see Figure 4.5).

The next most influential variable was psychological factors, followed by procedural and organisational variables.

For site managers, technical factors had least impact upon safety performance.

Site managers' attitudes also differed most from those of contract managers, and safety advisers in terms of economic and environmental factors than in areas of procedural and technical factors.

(b) Contract managers, and safety advisers differed in attitude to site managers in areas of economic and environmental factors.

(c) There were strong similarities in attitudes among the groups in terms of psychological factors, technical factors, organisational factors and in safety performance factors.

(d) Although some differences in attitudes exist from the statistical analysis, these were not sufficient to support the sub-hypothesis C, and its null-hypotheses.

The results of statistical analysis indicated that the pattern of behaviour of site managers was more similar to that of the safety advisers than to that of the contract managers.

The reason for this may be found in the level of liaison between site managers and safety advisers. In other words, safety advisers have more influence on site managers than contract managers, as far as safety standards and performance are concerned.

The outcome is quite logical in that the roles of the contract managers are very different from those of the safety advisers as far as they relate to the site manager on site. As such, role differences are likely to lead to differences of attitudes and ultimately, differences in levels of impact and influence upon the site managers' behaviour towards safety on site.

Note: Regional and Cultural difference `or' attitudes may play a role in influencing safety behaviour in the construction industry. For example, there may be cultural or regional differences amongst workers in Scotland, Wales, the Midlands, and London, which may shape safety attitudes or behaviour in construction sites.

However, this study whilst aware of the potential differences which such Regional and Cultural factors may cause, the author did not consider them in the research. Regional and cultural differences are therefore discounted.

CHAPTER FIVE

Discussion of the Results

CHAPTER FIVE

5 DISCUSSION OF THE RESULTS

5.1 INTRODUCTION

This chapter discussed the research findings resulting from the data analysis described in Chapter Four. More particularly, it pulls the results of the research together in accordance with the central elements or variables of the research model as detailed in Chapter Three (Figure 3.7). and prelude to the research conclusions in Chapter Six.

The central aim of the research was to compare the results with the predictive classifications discussed in Chapter Two (Literature Reviews), and Chapter Three (Review of Past Research Models), and to confirm or reject the research hypothesis

The main hypothesis is broken down into several sub-hypotheses as reported in Chapter Four above. The opposite to these sub-hypotheses are assumed to be null-hypotheses (of no relationship) and these are similarly considered above in Chapter Four.

The main statistics used for the data analysis are those of correlation coefficient, chi-square analysis or test of significance, and multivariate analysis. The results of correlation, chi-square tests and multivariate analysis are shown in Tables contained in the Appendix at the back of this work, for the purpose of reference. The results of chi-square tests which have significance levels of $p = 0.05$ are considered valid and acceptable as significant for the purposes of this research. In other words, those scores of 0.05 and above, are seen as establishing a good degree of association between one variable and another. Those with scores more than 0.250 may be considered as having a good degree of relationship, but are not considered as conclusive.

Although it is of the utmost practical and theoretical interest to establish the relationships which exist between employee and management attitudes towards safety and safety performance, nevertheless, any outcome should be viewed only as tentative. This is mainly due to the sample size (325) drawn from only <u>ten</u> companies, and representing only a tiny snapshot of an industry as vast as the construction industry.

Notwithstanding the above observations, any relationships established should be considered important enough to serve as useful pointers to all those interested in safety behaviour; be they policy-makers or safety practitioners at the company or site levels, or from the point of view of academic or future research interests

The results of the analysis in overall terms, have shown variable and significant levels of associations to exist between factors of safety attitudes, and safety performance. Whilst some degree of relationships are shown - the writer suggests however, some degree of caution, as chance have played some part in the relationships deduced from correlation coefficient, and chi-square test of significance. The results of multivariate analysis however, have reinforced the outcomes derived from correlation analysis and have furthermore highlighted the most dominant variable (factors) which impact upon safety performance.

5.1.2. Historical Factors (Variables)

The most prominent historical or biographical factors to emerge from this study which had impact upon safety performance consisted of the following:

i) company type and contract formation;
ii) training;
iii) age and experience.

a) Company Type and Contract Formation

Of the ten companies in the sample, most were classified by operatives and site managers as main contractors (72.22 percent); sub-contractors (21.43 percent) and only 6.35 percent were considered as self-employed.

Significantly, the majority of the sample indicated that they were working under a management contracting project arrangement (54.76 per cent). This awareness of contract packaging or formation shown by this group is quite significant in that any degree of contracting awareness may lead to an awareness of safety liability in terms of the individual and the company. This is because the form which a contract package takes determines the planning mode which a project adopts, and this has implications for the management of the health and safety at site planning level. All this affects the co-ordination of sub-contractors' input to the project itself.

Lomax (1989/9a. "The Builder") and Sidwell (1982) indicate that:

> "the relationship between contractual arrangement, and project success is essentially dependent upon the level of management control."

Hinze (1987) concluded in his research that:

> "Management control and good management on site, are essential for good safety performance."

b) Trade and Training

The largest individual group in the operative group was general labourers (36.51 percent), followed by carpenters and joiners (20.63 per cent) and bricklayers (12.70 per cent). Also the largest untrained group in this sample which acquired its skills mainly via experience and with a minimum of general training was the labouring group (49 per cent). The single most significant route followed by craftsmen was indicated as post-school apprenticeship (30.16 per cent) and then full-time and part-time attendance at technical colleges (7.14 per cent and 4.47 per cent respectively).

On the other hand, most site managers in the sample rose from the ranks of carpenters and joiners (31.08 percent), followed by graduates (28.38 percent), and 22.97 percent had technical college education ranging from ONC/D to HNC/D etc., and City & Guilds.

Interestingly, most Contract Managers were Technical College-educated (30.36 percent), followed by University graduates (25 percent), and those who originated from the background of carpenter and joiner (23 percent), bricklayer (12 percent), roofers and electricians (2 percent) and general categories (5.36 percent).

It is significant to note that aside from graduates and technical college-educated, carpenters and joiners form the single largest craft or trade group to have risen to management status in the construction industry 31 percent - site managers, 23 percent contract managers and 22 percent safety advisers).

An examination of the above statistics indicates a poor showing for operatives of the labouring group in terms of structured training including safety training. From the above results, it is not surprising that 'learning by experience' rather than via a formal and well-structured training scheme, followed at training centres or college, failed to feature in the scheme of things, since the largest individual operative group was labourers (46 per cent). A large untrained labour force would therefore have serious implications for safety performance on site at the operative level.

c) Membership of Professional Institutions

The data analysis showed that operatives did not belong to professional institutions, but rather belonged to craft-based organisations.

On the other hand, a high proportion of managers belonged to professional institutions. The explanation for this is that achievement of professional status became a symbol of professional attainment and experience as well as competence. For example, the results showed that for site managers, 28 per cent were graduates, followed by 27 per cent members of the Chartered Institute of Building, and 12 per cent had either HNC/D, ONC/D or B.TECH etc.

Despite these qualifications, the interviews indicated that safety education and experience were gained after qualifications, rather than as part of the course taught. The majority of the group had indicated a preference for safety being included in all professional qualifications as a proper examination subject.

Similarly, for Contract Managers,	27 percent were CIOB members;
	16 per cent were RICS members;
	13 per cent were graduates, and
	9 per cent were ICE members.

Of the remainder, 39 percent had HND/C; 18 per cent City & Guilds qualifications of one type or another, and 16 percent had OND/ONC respectively.

Most importantly, 39 per cent of all Contract Managers indicated having received Health and Safety instructions as a taught subject in their training course.

Finally, all Safety Advisers belonged to professional institutions as follows:

IOSH	=	55 percent
CIOB	=	33 percent
MIIRISK	=	7 percent
ICE	=	2 percent
Others	=	4 percent

All had safety as a taught/examination subject.

The significance of this is that if safety was to be adequately managed in the construction industry, then all management in the industry must be well trained and educated in all aspects of safety.

Results of statistical analysis also showed a strong correlation between training generally, and safety training in particular to be significantly associated with safety performance (refer Tables 4.17 ($p = 0.05$); Table 4.25 ($p = 0.01$) in Appendix K). The results indicate that site managers and Contract Managers are lacking in safety training in the early stages of management compared to Safety Advisers or Managers.

AGE AND EXPERIENCE

The results showed age and experience as perhaps the most significant factor in accident causation involving the construction worker. Vernon (1944) stated that 'usually the two are so closely bound together that it is impossible to disentangle them'.

This result is significant since the age and experience of the average construction worker from operatives to management was between 21 years and 45 years. Schulzinger (1956) demonstrated that accidents are most frequent in the age range of 17 (seventeen) to 28 (twenty eight) and that they decline steadily after that to reach a low point in the late fifties (50) and sixties (60). Furthermore, the tendency for individuals to experience more frequent injuries during their early years in the labour force, is one of the most consistent findings in the accident or safety field (Haddon, Suchman and Kline (1964)). Grew (1958) also reached similar conclusions. Also that older men are unable to meet the demands of such job types, unless they are modified to match their capabilities.

Whilst the above findings may be generally true of all industries, it is particularly pertinent to the construction industry, as the research results showed. It showed that those under 30 years old complained more about the general conditions of their work, and its environment than their older counterparts (of 46 years or older), for whom the physical conditions of construction were viewed by many as requiring energy rather than technique or flair.

For construction, and particularly as far as this study is concerned, the result showed the most dominant age group for site managers to be between 30-40 years; for Contract Managers- 41-45 years and 36-40 years, and for Safety Advisers - 41-50 years, followed by those of 36-40 years old.

The least represented age group were those between 25-30 years old who were in the minority in all the above management categories.

An explanation for this result may be that the older generation of managers took longer to acquire the necessary knowledge and skills to gain promotion than the younger generation who are more likely to have university or Technical College education. For these, early academic, technical and professional qualifications may enhance speed of learning and experience, and hence early promotion to managerial levels. These groups tend to be more adaptable to industry changes than their older counterparts (management pilot interviews, 1984).

5.1.3. <u>Economic Factors (Variables)</u>

The results of correlation coefficient and chi-square test of significance (see Appendix K, Tables) had revealed certain interesting results seen from data analysis reported in Chapter Four above.

The most significant findings were as follows:

a) Strong association exists between paying 'danger money' and safety performance (correlation coefficient = 0.366 and p = 0.001 - see Appendix K - Table 4.16)

Fifty six percent (56%) of operative sample indicated opposition to any form of 'danger money' being paid in the construction industry. The perception was that paying any form of 'danger money' was tantamount to an inducement to take risks, and that such an inducement ran counter to the aims of safety promotion on site, and in the construction industry generally.

The construction site is obviously a more dangerous place to work in than the typical factory floor where the process of production is not only systematic, but also takes place in a more controlled and constant working environment. The construction site is often at the best of times- chaotic, as various operations/activities take place simultaneously due to the proliferation of sub-contractors, and this makes management control of these activities often impossible. As such, any additional incentive to take risks through payment of 'danger money' will only exacerbate an already troubled environment or situation.

b) Banksmen training was found to be inadequate by the result. However, the result indicated that there was no relationship between banksman training and safety performance. Despite this result, safety advisers, contract managers and site managers had indicated that 'banksmen's training was highly significant.

However, education of the operative groups on the role of the 'banksman' is critical to successful safety procedures on site.

c) Bonus payments: The results showed that there was a relationship between bonus payments and safety performance. The explanation for this was that bonus payments lead operatives to achieve higher production through performing unsafely at the site level. It is therefore an incentive to work faster than was usually the case, and in the process, unsafe methods of work by chance-taking became the norm, and hence accidents (Leather (1983), Peterson (1982)). Peterson (1982) observed that

> 'people commit unsafe acts because they have been rewarded in the past for doing so; that is, operatives received bonus payments for extra productivity that may have been achieved by performing unsafely.'

The result of the research concurs with the above. It indicated that bonus payments also influenced supervisor behaviour towards safety (ref: Table 4.18, Appendix K- correlation coefficient 0.701; p = 0.001, also see Leather (1983); Shimmin *et al* (1982).

Rather than paying bonuses as an incentive for higher productivity without due regard for safety, the research indicated that 'safety bonuses' should be paid instead, as they have a significant and positive association with safety performance, since they combine productivity and safety performance as a goal for reward. A Safety Bonus was found to enhance safety performance and productivity (see Table 4.19 - Appendix K, correlation co-efficient = 0.839, p = 0.001).

Generally, operatives' bonus schemes in the construction industry were perceived as a constraint to good safety behaviour, and were believed by site managers to have an impact upon the achievement of a favourable level of safety performance on site.

Similarly, contract managers and safety advisers felt that bonus schemes interfered with safety organisation on site. Leather (1983) concluded that:

> " ... that management was indeed concerned with the problem of bonus. That is, a staggering 67% of foremen, and 42% of housing managers in the Public Sector Group did consider bonus targets to be a major contributing cause of risk-taking, and corner-cutting by the direct labour operatives."

He went on to state that:

> "In the private sector ... some 55% of foremen thought its [bonus] influencemight work in that direction."

For this research, 74 per cent of safety advisers/officers, 55 per cent contract managers, 51 percent site managers and 63 per cent operatives expressed similar views as Leather's (1983) conclusion.

This result is therefore considered as highly valid and significant.

d) *Risk-taking was seen as a common nuisance, and it hampered safety promotion efforts in* the construction industry, whilst statistically a high association exists between 'risk-taking' and safety performance. Nevertheless, risk-taking was considered as an industry 'norm' construction culture, since the industry was perceived as dangerous.

If the industry was seen as a dangerous environment, then risk-taking was considered an inevitable consequence that needed to be combated by safety practitioners. It should be driven home to workers that because the industry is dangerous, all the more reason why risk-taking ought to be minimised, so as to reduce or avoid the risk of accidental injuries to the individual worker or group.

It is clear from the results that increased productivity, and good safety performance can go hand-in-hand (see Table 4.21 - Appendix K, correlation coefficient = 0.803, p =0.001).

5.1.4. Psychological Factors (Variables)

a) Personal and Group Care for Safety on Site

Examination of the statistical analysis indicates that relationships exist between personal care for own safety and safety performance (see Table 4.23 - Appendix K, where correlation coefficient was 0.718, with a chi-square p = 0.001). This means that where the individual showed concern for personal safety, and reflected this concern in their approach to their work, safety performance or the chance of that individual having an accident, would reduce, compared to others who neglected their personal safety in the course of their work.

Similarly, care for workmates' safety was not considered as essential as care for one's own safety. The results showed that no association existed between workmates' safety and safety performance. The explanation for this low score may be that personal safety was put first before that of others, simply because construction work was seen as a group, but nevertheless a competitive activity. In any group activity, it may be that human instinct dictates that personal survival comes first unless where the safety of the individual is dependent upon the safety or survival of the group.

Construction work is generally a team or group activity; as such, the well being of members of the team or group would be viewed as essential to team spirit and group performance. Since the group is composed of individuals, it may be safe to assert that a group composed of safety conscious individuals would make a safety conscious group, and thus enhance group safety performance. From this, it is significant to propose that group training in safety must highlight the importance of developing a group sense of shared responsibility between the individual, group and management, where safety was concerned.

b) The Impact of the Health and Safety Act, 1974

The Health and Safety Act was shown to have significant impact on safety performance and an association was indicated statistically to exist between the two variables (Tables 4.24- Appendix K).

For this reason, knowledge of the 'Act' must be considered of primary importance where operative training is concerned.

Amongst the operatives' sample (N = 126), knowledge of the Act was indicated as a significant source of influence on the creation of safety awareness in the construction industry (63%). This outcome also confirms the result of research by the author in 1982 (Sawacha & Langford, pub. 1986).

c) Training and Experience

Skill training, safety training and experience were seen as the most significant source of influence in terms of good safety performance in the construction industry. The research results showed a correlation and significance between the above and safety performance (see Tables 4.25/27 in Appendix K), and section 5 2 above for detail discussion.

Various research has also shown that knowledge and experience of the task or job was significant for an efficient safety performance (Shimmin *et al* 1982; Leather(1983), Perusse & Hale (1980).

d) Supervisors' Safety Behaviour

The research statistical analysis showed that a relationship exists between supervisors behaviour and safety performance (see Table 4.28 - Appendix

Operatives' expectation of their supervisors' safety attitudes is relatively high, and they see their supervisors' safety attitudes and behaviour as being a major source of influence upon their own safety behaviour on site. Amongst the operative group, responses indicated 77 per cent perceived their supervisors' safety behaviour on site as highly essential for them as a role model.

Other researches had reached similar conclusions in the past which makes this finding valid, for example, Davies and Stachi (1964) found that

> "frequent daily contact between workers, supervisors on safety and other job matters, is most important to accident control efforts. Top management's attitudes towards safety is also a significant factor."

Andriessen's (1978) study reached a similar conclusion. It states that:

> "Workers will work more safely with a supervisor who is seen as someone who respects his workers and their contribution, and who is stimulated by a distinct company policy on safety. Because they see that their supervisor regards safety equally important as production, they can also expect that he will react positively, when they work safely. (see pg. 61 above for detailed discussion of the study)."

The above confirms the outcome of this research as valid and significant

5.1.5 Technical Factors

The most significant technical factors found to impact upon safety performance were:

a) Awareness of asbestos as a health hazard ($p = 0.05$)
b) Recognition of asbestos ($p = 0.001$)
c) Information on asbestos available to the workforce ($p = 0.001$)
d) Proper use of scaffolding and ladders ($p = 0.005$)
e) Adequate daily scaffolding inspections ($p = 0.001$)
f) Building experience and use of common-sense in scaffolding erection ($p = 0.001$)

g) Training skills of steel-erectors (p = 0.05)

h) Plant driver training (p = 0.05).

The most significant factor in safety performance is the human factor the human factor used therefore to eliminate or avoid accidents, but there must first be an awareness of what causes accidents in the work situation or environment.

The above constitute some of the causes of accidents as far as this research is concerned. The more common causes of accidents are tabulated in the Appendix - Table 4.15b - see Appendix N).

The research found that despite the awareness of asbestos as a source of health hazards (expressed by 98%) of the sample, only 55 per cent felt confident that they would recognise it if exposed on site. Most surprisingly 58 per cent thought that they would be to blame should they handle asbestos, or work with it without adequate protection, despite believing that the company had overall responsibility for informing employees of the presence of asbestos in the workplace or site. Asbestos information to operatives by management was indicated as lacking by 77 percent of operatives.

Ladders and scaffolding were similarly found to be a great source of accidents in the construction industry. As such most operatives (79 per cent) indicated that only technical trained persons should erect them, and carry out regular safety checks and inspections if accidents were to be avoided. They felt that common-sense and building experience alone should not be the qualification for erecting it on site. Eighty four percent (84%) believed that good technical/skill training and experience were the only criteria which should be recognised, and that all erectors of scaffolding and inspectors should be certified as such. A similar view was indicated for steel erectors.

The operation and use of mechanised plant and equipment was also found to be a major source of accidents on site. Despite that, operatives indicated that supervisors and site managers would instruct uncertified persons to operate, use or drive them on site when the usual operator was found to be absent on site to do so. Ninety-two per cent (92%) of operatives were unhappy with their supervisors operating or using them before they were adequately trained.

The same opinion was expressed about operating site transport. Some form of certification was considered necessary before anyone was allowed to operate or drive a dumper or other mobile vehicle on site. Sixty four per cent believed that experience and common-sense alone was inadequate.

An effective remedy to avoid the shortcomings expressed above would be a consistent policy of hazard identification and assessments on individual sites throughout the construction industry. Research has found that 'hazard identification or assessment are considered to be a highly significant factor in attitudes towards risks in general and safety performance in particular (Robaye (1963), Hale and Hale (1970)).

A point of view generally held by safety advisers/officers in this research, and as evidenced by previous research is that the results of hazard identification and assessment exert considerable influence upon the choice of action taken (CITB, 1972; APAU, 1980). Further discussion of previous research are detailed on page 47 above, which validates this research result.

5.1.6 Procedural Factors

Procedural factors were found to influence safety performance, and those indicated as most significant variables were as follows:

a) Provision of protective safety clothing and equipment ($p = 0.001$);
b) Non-use of protective safety clothing and equipment;
c) Issuing of suitable quality, and adequate safety equipment;
d) Provision of adequate training on the use of protective safety clothing and equipment;
e) Provision of a safety booklet/manual, together with induction training for new recruits to the industry ($p = 0.001$).

The provision of good quality safety equipment and clothing is seen to have a significant influence on safety awareness and performance. However, workers must be trained and familiarised with methods of use in order to have maximum impact upon the individual's safety performance. Having trained workers on the use of protective safety clothing and equipment, they should be encouraged and cajoled as necessary to ensure they use them as specified and maintain them properly to give maximum protection. Workers indicated that the failure to wear/use them ought to be a punishable offence through sanctions imposed on the offender. They suggest that such a sanction should be written into Contracts of Employment - a view expressed by 68 per cent of workers in the sample ($N = 126$). The study showed that management did not give enough importance to the training of operatives on how and where to use protective safety equipment and clothing. Rather, whilst they were good at the provision of this clothing, workers were left to use their own discretion most of the time. Sixty one per cent of respondents expressed the need for training on the use of supplied clothing and equipment as being a high priority on site.

As part of the training in safety, 90 per cent of operatives felt the need for the provision of safety manuals or booklets to all workers on site throughout the construction industry. Their belief was that the issue of safety manuals or booklets promoted (created) and reinforced safety awareness, improved company image by showing that the company cared about safety and lead to improved safety performance. The result indicated that, to ensure maximum safety impact, all new recruits would be given induction training in safety on entering the industry and also each time a worker changed companies, irrespective of the individual's experience or status.

It was agreed by 89 per cent operatives that induction training must make reference to a safety manual or booklet provided by the company each time if safety awareness was to be sustained for the key purpose of enhanced safety performance. Finally, (APAU, 1980) concludes that the three ways of preventing accidents are:

(a) By making the working environment as safe as possible;
(b) by protecting the workers from hazards by the provision of protective clothing etc. and
(c) by training; all confirmed by this study.

5.1.7 Organisational Factors

Organisational variables were found to have significant influence on safety performance (see Section 4.5.6 above) for statistical results. The most significant variables found to have associations with safety performance were:

(a) Worker-management relationships ($p = 0.001$);
(b) Sub-contractor safety behaviour on site ($p = 0.02$);
(c) Safety representative presence on site ($p = 0.001$);
(d) Management-workers co-operation on safety issues ($p = 0.001$);
(e) Safety committee input to safety policy and programmes ($p = 0.005$).
(f) Regular safety talks by supervisors/management to workers ($p = 0.001$);
(g) Displaying good quality safety posters on sites ($p = 0.005$).
(h) Job skills and knowledge ($p = 0.001$). Tables 4.58; Appendix K).

Like most human relationships, workers and management relationships on site were found to have a significant association with safety performance (see Tables 4.5.7 - Appendix K). Operative perception indicated that good worker management relationships on site promoted good safety performance, and that the reverse was equally true (this was the view of 78 per cent of operative response and supports the results of the statistical analysis as shown in the conclusion of section 4.5.6 in Chapter Four above.

Various research confirmed all the findings of this section as listed above ((a)-(g))- Hinze (1978); Levy and Green (196Z), Andriessen (1978) and Leather (1983) etc. For detailed discussion of these research refer pages 48 - 62 in Chapter Two above.

5.1.8 Environmental Factors

The most significant environmental factors found to influence safety performance in this study were:

(a) Site conditions, e.g., clean and tidy or untidy (p = 0.001); (refer Tables 4.57/59 in Appendix K);

(b) Worker's co-operation with each other on site (p = 0.001); (see Table 4.60 - Appendix K)

(c) Planned and organised sites - (p = 0.001) (See Tables 4.63 - Appendix K), and

(d) Workers' individual carefulness about safety on site (p = 0.001) (see Table 4.62 - Appendix K)

Again, these results listed above are validated by previous research as discussed in Chapter Two above, particularly those of HSE Report (1976) as discussed on page 62, para 4; APU (1980) page 63; and Leather (1983) etc.

5.2 ATTITUDINAL/BEHAVIOURAL PATTERNS OF OPERATIVES AND SITE MANAGERS

This section reports the pattern of behaviour of operatives' attitudes compared with those of site managers.

The purpose of this section is to investigate any similarities or differentiation between them as far as the chosen research variables are concerned. The basis of comparison remains the chi-square test of significance calculated by using MINITAB *statistical package as described in Chapter Four* above.

It is important to note that since no other studies which compared operative and site managers' attitudes was found at the start of the study, any conclusions reached should be considered as tentative. This is mainly because the results can not be validated using previous research findings whereby direct comparisons would be possible. Nevertheless, statistical validation can be acceptable as far as research purposes are concerned. As such, the findings in this section can be acceptable as valuable information contributory to this field of research.

5.2.1 Outcome Or Analysis of Attitudinal/Behavioural Patterns of Operatives and Site Managers

The pattern of behaviour of operatives and site managers were established after the first detailed analysis of individual data for each of the groups, to test whether there were any similarities or differences in their attitudes towards the attitudinal variables as indicated in the research model detailed in Figure 3.8 above.

The pattern of behaviour of operatives and site management were established after the initial analysis of data provided by each of the groups. The first analysis was to investigate and establish general attitudes towards the chosen variables and to see if they had any significant relationships with safety performance. After this first analysis was completed, the results of the analysis were then paired and subjected to chi-square analysis (test of significance) using MINITAB, to see if any pattern of behaviour (attitudinal) exist between operatives and site management as far as the selected attitudinal variables were concerned.

The general findings can be described as follows:

a) Historical Factors

Results of the whole sample of operatives (N = 126) and site management (N = 74) showed that operatives' attitudes were not dissimilar to those of site management in respect of factors such as age, training, experience, and knowledge of companies for which they worked, as discussed in 5.1.2. above.

The effect of age, training, experience and company type towards safety performance were influential to both groups (Leather (1983); Hinze (1987)

The age range for operatives and site management were on average between 28 years and 45 years. However, their levels, and types of duties performed, and their levels of responsibilities differed, despite being exposed to the same site environment. It is therefore logical that the impact of age upon safety performance would not vary, although operatives are more likely to be exposed to the rigours, and hence the danger of the site. This is because operatives by virtue of the nature of their work, would be more directly exposed to the activities which possessed these safety hazards, and hence have direct attitudes to safety.

Site management is found to be better trained than the operatives; again because of the level of their overall responsibilities for the site, and their managerial training and experience. Because of the advantageous position which they hold and their type of training and experience, would have a more in-depth appreciation of safety hazards around the site, and thus better equipped to avoid the pitfalls arising from the condition of the site and task performance.

Finally, the manager controls the site activities and as a result, the tempo of site activities. Management control has been found by previous research to influence safety performance (Andriessen (1978), Leather (1983), etc. Despite the differences in their training background, age and experience has similar influence upon them.

b) Economic Factors

Results of the statistical analysis showed that predominantly no differences exist between operative and site management attitudes towards the economic variables examined in the research (see Tables in Appendix - L).

Examination of the results showed that most variables were found to be mutually significant according to chi-square test of significance, which ranged from $p = 0.05$ to $p = 0.001$ indicating that association was common between the group (see Tables).

For example, the proposition that 'bonus systems lead to reduced concern for safety on site' was found not to be significant by both groups, thus signifying similarity in attitudes towards bonus systems and safety on site.

On the other hand, other variables indicated associations to exist. These were that:

a) Need to meet commercial or profits influenced safety organisation on site - $p = 0.001$
b) Bonus systems lead supervisors to turn a 'blind eye' to safety hazards on site - significant at $p = 0.001$.
c) More training lead to safety improvement on site - $p = 0.001$.
d) Safety bonuses improve safety performance - $p = 0.05$ and
e) Productivity with safety performance - $p = 0.001$.

All the evidence from the literature review confirms the idea that these are the economic factors which influence safety performance. As such, more attention should be paid towards them in training, construction education and contracts or tendering documentation. By so doing, it is assumed that steps would be taken in the long run to limit their effects on safety performance across the construction industry.

c) Psychological Factors

Again, like b) above psychological variables were shown to have significant association to safety performance, and that there was mutual agreement between operatives and site management.

The factors found to be significant are shown in the Tables in Appendix - L, and pertain to:

As site management spends more time in communication with the operative group than any other managers, it is logical to expect that both groups will influence each other's attitudes on factors affecting their work on site, and hence the similarities in attitudinal behaviour in terms of psychological variables. Because of this result, it is logical to propose that the more joint safety training is encouraged, the more positive attitudes will prevail amongst operatives and site management, which will enhance safety performance on site.

d) Procedural Factors

Operative and site management were found to have similar opinions or attitudes towards procedural factors in the construction industry.

They jointly indicated their agreement to the fact that the provision of protective safety clothing and equipment was significant, as $p = 0.02$.

Similarly, the results indicated that, where workers failed to wear them, they should be punished through sanctions.

Also if workers were equipped with safety manuals or booklets during safety induction on entry into the industry, it is the belief of operatives and site management alike, that safety on site would improve as a result.

These results reflect the nature of the operative, and site managers' work compared to other managers. Site managers seem to spend more time within the site environment interacting with operatives and other parties of the construction process. As such both groups have more to benefit from the provision of safety protective clothing etc. and safety manuals or booklets. For this reason, it is inevitable that they should have similar attitudes, since attitudes are shaped by environment, common or shared experience and regular communication between the group; particularly when the communication is controlled by the working environment.

e) Technical Factors

Examination of the results showed that operatives and site management considered technical variables to be very significant, and had similar levels of attitudes towards them (see Tables in Appendix).

Both operatives and site managers are expected to have knowledge of safety hazards, and what steps should be taken to avoid them. The most current and significant approach to avoiding hazards is through hazard identification.

Current thinking is that although the site manager has overall responsibility for the control of the site, and the diverse nature of activities taking place within it at any given time, he/she alone should not be trained in hazard seeking. It has been suggested that all members of the construction process on site should be able to conduct their own hazard identification so long as they have a contractual involvement to undertake activities within the site (Apau (1980)).

Since site managers and operatives are exposed to similar hazards (though to varying degrees of exposure), it is only logical that they should have shared attitudes towards hazards and other technical variables arising from the site condition or environment. Shared attitudes, it is hoped, would induce better safety on site.

f) Organisation Factors

One of the most important variables to emerge from this study as having the most significant impact upon safety performance was organisation others being psychological and environmental variables.

The reasons for this may be that because management activities on site consist of planning and co-ordinating, communication (with all those involved with the site), problem-solving, monitoring, controlling and decision-making, their position or presence on site influences all aspects of the construction process. Similarly, psychological variables are a result of human activities and behaviour, whilst the environmental variables are source of influence to persons and the construction site itself.

For this reason, it is inevitable that those organisation factors examined in the study should affect both site management and operatives. Site managers control the site organisation, which invariably controls the operative. As such their attitudes are intertwined and thus likely to be similar in most respects other than in managerial duties which are a managers' prerogative.

The results showed that apart from differences in duties and responsibilities, organisation factors, influenced both operatives and site managers alike (see Tables in Appendix L), where all variables examined indicated high correlation and significance, thus confirming their similarities of attitudes.

g) Environmental factors

Of all the environmental variables examined in the study, only three emerged to indicate that significant similarities in attitudes exist between operatives and site managers. These were:

i) The effect of untidy sites upon safety performance;
ii) Good job planning and site organisation/layout, and
iii) Workers who know their jobs and are thoughtful of the way they carry out their work - are less likely to cause accidents

All three variables scored very high significance on the chi-square test of significance where p = 0. 001 .

The results showed that untidy sites caused accidents; good job planning and site organisation had the effect of reducing accidents, and that workers who know their jobs (skilled), and who are thoughtful of the way they did their work, have less accidents (see Tables in Appendix L); Leather (1983); Andriessen (1987), etc.

5 3. PATTERN OF ATTITUDINAL BEHAVIOUR OF SITE MANAGERS, CONTRACT MANAGERS AND SAFETY ADVISERS ETC.

Like 5.2 above, this section reports the pattern of site management, with those of contract managers and safety advisers/officers/managers. The purpose being to see if there were significant similarities or differences between the groups (see 5.2 above). The results of the analysis are discussed below.

a) Historical Factors

Examination of the literature review and the research data indicates similar findings as those discussed in 5.2 1 a) above.

However, it is important to note that in spite of the existence of a considerable number of studies of managerial behaviour (Minzberg (1973), McGregor (1960), Likert (1961), Maslow (1954), Lawrence and Lorsch (1967) etc.) direct comparisons are not possible, since these studies related to different subject areas, and therefore, methodologies differed markedly to this study. Therefore direct comparison was only made with studies of safety behaviour as discussed in the literature reviews, and the research data discussed in Chapter Four above.

Generally, the factors of age, training and experience were found to be similar to those of site managers as discussed above (see Sections 4.7.1 and 5.2.1 a) above).

b) Economic Factors

An examination of the results indicated that differences exist between the attitudinal behaviour of site managers and those of contract managers, and safety advisers etc. (see Tables of analysis in Appendix M, and section 4.7.1a) above).

The most significant differences occur in site managers' perception of the affects of: bonus schemes, safety training, commercial influences upon tendering strategies, cost of safety in jobs or contracts, and client contribution or non-contribution to the enforcement of safety inputs in contracts.

i) Bonus systems upon safety performance;

ii) Safety training upon safety performance;

iii) Commercial influences upon tendering strategies;

iv) Cost of safety allowed for in jobs/contracts and its effect upon safety performance, and

v) The client's level of contribution or non-contribution to the enforcement of safety inputs in tendering, and contract procurement.

Contrary to the above, contract managers and safety advisers etc. have similar attitudes in respect of all the above elements.

The possible explanation for these differences might be in the differences in the roles and responsibilities of site managers and those of contract managers and safety advisers etc.

These differences could have implications for safety management at the contract stage, as well as at the site level, as different decisions are made in accordance with company safety policies, commercial or financial consideration of the environmental influences that affect the site management decisions These decisions might impact upon safety performance throughout the construction process or contract.

However, there was mutual agreement or similarities of attitudes amongst the groups in issues related to operatives or workers' safety awareness, and the awards of safety performance, and their positive influence upon safety performance.

In order to counter the effect of the differences in attitudes or perceptions discussed above, perhaps a more co-ordinated approach is needed in the relationships and roles of site managers, contract managers, and safety advisers at pre-tender stage, and throughout the contract/project planning and co-ordinating phases of the construction process. Such an approach might lead to positive signals from management to operatives that management was serious about safety on site (refer Andriessen (1978); Leather (1987)).

c) Psychological Factors

Great differences exist in the pattern of attitudes/behaviour among the groups as far as psychological factors are concerned. Again the margin of variations amongst the groups' attitudes towards the psychological factors examined is quite significant (Refer Tables of Analysis in Appendix M).

Similarities of attitudes or perceptions only occurred in four elements out of the ten examined, and these were as follows:

There were dissimilarities as far as attitudes towards investigation of 'accident near-misses' and consideration of safety methods statement at the tender stage of a contract are concerned.

Again, site managers showed differences in attitudes to those of safety advisers and contract managers.

The same explanations given above might apply here (see b) above).

It is interesting to note that so far, contract managers and safety advisers appear to share similar attitudes compared to site managers and this is significant as far as the research is concerned. May be there is more interaction between contract managers and safety advisers, despite differences in role. If this is consistent with industry norm, then perhaps a rethink is appropriate, so as to enhance measures currently taken to improve safety performance in the construction industry.

d) Technical Factors

There are no differences in the pattern of attitudinal behaviour towards technical factors amongst site managers, contract managers and safety advisers etc.

This is significant because the items considered under this heading relate to practical issues which are consistent across the industry, as they are experienced daily by the construction management groups either on site, or in construction offices, and have implications for organisation and safety policies (see Tables of analysis in Appendix M).

It is significant to note that the most prominent elements in technical factors which might influence safety performance are:

i) operation of mobile plant or equipment by those not trained or certificated to operate them.
ii) provision or lack of provision of safety information to the workforce;
iii) training of managers in safety, particularly contract managers and site management;
iv) wearing or using protective clothing and equipment as required or specified by safety standards;
v) current tendering methods and safety in Contract implementation, and
vi) work pressure and fatigue.

These were found to be significant influences on safety performance. The results indicate that it is customary for some site management groups (i.e. supervisors, forepersons and managers) to instruct untrained or uncertificated persons on site, to operate equipment or plant, when the qualified or competent operator was absent from the site for one reason or another. There may also be the motive to save costs, so rather than employ a temporary operator or transfer one from another site in the short-term, they would 'make-do' with a volunteer on site. Operatives indicated that they would prefer only certificated and trained operators to handle mobile plant or equipment on site.

If the above result is a true reflection of industry norm, then it has serious implications for safety performance in the construction industry.

e) Organisation Factors

Again, similarities in attitudinal behaviour are predominant amongst site managers, contract managers and safety advisers with regard to those organisation variables examined in the study (see Tables in Appendix M).

Interestingly, the most prominent factors of organisation variables found to significantly influence safety performance were those involving persons or groups who had one level of authority in the company or contract organisation or the industry at large. These are as follows:

i) Worker-management relationships and co-operation on site.
ii) Trade Union involvement in safety matters at company (organisational) level or more directly at site level, e.g. safety committees and Safety Representatives in Safety Audit implementation.
iii) Integration or differentiation of site managers' and safety advisers' etc. duties and responsibilities at contract procurement stage, and site organisation processes.

For example, their duties and responsibilities should be clearly defined and areas of co-operation earmarked to speed decisions on matters of safety on site. Direct involvement of the safety adviser or consultant etc. should be encouraged, rather than left as advisory roles only; this of course would depend on the size and complexity of the project

iv) Managers' and supervisors' frequency of talking about safety to operatives or site-based workers. Previous research found that managers/supervisors who talk frequently about safety to their workforce on site, have better safety performance or less accidents on site. Wilkinson (1975) states that managers, particularly safety managers must learn to talk about safety to their supervisors in top management terms if they are to get attention. Davies and Staehl (1964) also found that frequent daily contact between workers and supervisors on safety and other job matters is most important to accident control efforts. Top management's attitude towards safety is also a significant factor."

Leather (1983) on the other hand found that:

> "Supervisors who never talked to their workers about safety are also never seen conducting a safety inspection.
>
> Supervisors who do not talk to their employees about safety are observed differently regarding the conduct of safety inspections, depending on whether the employees perceived them to be serious about safety or just following instructions ... "
>
> (see Literature Review p 58).

v) More Factory Inspectorate's activities in the building industry improves safety performance.

vi) Management safety attitudes determine workers' safety behaviour on site (refer Barrow (1977) in Chapter Two, para 5, p56 above; Cohen *et al* (1977) p67; Andriessen (1978) p61, above, and finally,

vii) Poor co-ordination of sub-contractors' work on site influences safety performance adversely (refer Apau (1980)).

These findings are supported by other research discussed in the Literature overview in Chapter Two above.

f) Environmental Factors

Various studies have in the past shown the significance of environmental factors in accidents or safety performance in the construction industry (Hale and Hale (1972); Blum and Naylor (1968); Leather (1983); Kay (1978) etc.

This study however, apart from confirming the findings of the above studies, indicates that differences of opinion or attitudes prevailed between site managers, contract managers, and safety advisers as far as those environmental factors examined in this research are concerned (see Tables in Appendix

Those factors which showed strong similarities of attitudes amongst the groups were those indicating that:

i) Having a single contractor responsibility for scaffolding on a site was important for the improvement of safety performance on the site.

The implication of this outcome is that where medium to large construction projects involve the use of scaffolding, a single scaffolding contractor ought to be appointed to take this responsibility, and that such a contract would improve the safety standards of scaffolding and hence safety performance. The result suggests that where a single contract responsibility for all scaffolding is maintained, better scaffolding co-ordination is also achieved.

ii) Untidy building sites lead to accidents (see Literature Review in Chapter Two above).
iii) Older workers' safety attitudes were a source of influence to new recruits to the construction, and
iv) Workers and managers can reduce most accidents on site by being a little more thoughtful about safety provision in their jobs. (Leather (1983)) also reached a similar conclusion).

As far as the differences in attitudes are concerned, the results showed that site managers, and contract managers had closer similarities than with safety advisers. These were on factors such as:

i) Provision of quality welfare and first-aid facilities improved safety standards (Atherley (1973); Miller (1973); McKenna (1978)).
ii) Provision of workers with thermal or warm clothing in winter reduced accidents.

Ergonomist had indicated the effect of weather conditions (i.e., severe heat or cold) to affect human concentration or judgement which can lead to accidents.

They profess that: "Ergonomic factors have an influence of some degree on importance; indeed ergonomists see this factor as one of the key causes of industrial accidents." (Wearne (1982), Wilson (1979), and Singleton (1974)).

iii) Good job planning and site organisation improves safety performance (see Literature Review).
iv) Inadequate supply of quality plant or tools of the right types leads to accidents.
v) Inadequate supervision and control of workers on site is a major cause of accident occurrence on site.

Of all the environmental factors, the most significant as far as influence upon safety performance was concerned are:

i) Workers' and managers' continued thoughtfulness about safety performance;
ii) Behaviour of older workers;

iii) Dirty or untidy sites, and

iv) A single contractor responsibility for scaffolding on site

h) Safety Performance Factors

Ten individual elements of safety performance were examined to see if similarities or differences of attitudinal behaviour exist amongst site managers, contract managers, and safety advisers. Of these elements, four showed similarities of attitude common to the group; three showed similarities common to contract managers and safety advisers; two with similarities between site managers and safety advisers; and one with similarities between site managers and contract managers (see Tables of Analysis in the Appendix M). Again the results suggest that contract managers' attitudes to safety are closer to safety advisers than Site managers.

Those elements showing strong similarities in attitudes amongst the groups according to the result are:

i) That hazard identification, analysis and up-dating by management would lead to improvement of safety performance.

The only condition being that it becomes a safety requirement throughout the construction industry, and enforced by the Health and Safety Inspectorate annually. Alternatively, it should be self-regulatory as part of safety audits, with annual returns sent to the HSE for verification. Those companies who fail to make detailed Returns could then be queried or penalised through fines.

ii) Hazard identification should be a statutory requirement as a way of improving safety standards.

iii) That alcohol and drug abuse are a problem for safety in the construction industry, and that there was a need to highlight it as a problem, and deal with it as such.

iv) That lack of proper consultation amongst clients, designers/engineers, managing contractors, subcontractors and managers throughout the project development phases undermines safety performance on site.

The above findings are confirmed by various studies discussed in the literature reviews in Chapter Two of the above.

Secondly, contract managers and safety advisers' attitudes are much closer with regards to the opinions that:

i) Regular safety assessments on a competitive basis increase safety awareness and might lead to improved safety performance. Such an assessment should be part of safety bonus understanding across the industry.

ii) The Health and Safety Inspectorate have inadequate resources to enforce safety in the construction industry and that,

iii) All companies in the Building Industry should have alcohol and drugs-free policies.

Thirdly, common attitudes prevailed between site managers and safety advisers in regards to beliefs that:

i) Displaying all accident information on sites prevents risk-taking by workers, and
ii) Safety provisions in tender documents are too vague for promoting better safety on site.

Lastly, site managers, and contract managers believe that most accidents occur on multi-occupied sites due to inadequate control of sub-contractors

The explanation being that poor control of sub-contractors on a multi-occupied site is the result of poor co-ordination and inadequate managerial resources, particularly on very large and complex projects.

These results have demonstrated that major differences of attitudes exist between site managers, contract managers and safety advisers.

It is significant to note that where differences to safety prevail amongst the groups or between one group and the other, the difference(s) might lead to conflicting management safety behaviour that will have implications for safety management.

It might therefore be necessary to minimise those factors of attitudinal differences so that controlled steps are taken through joint training, using psychologically based techniques.

5.4 DISCUSSION OF RESULTS OF MULTIVARIATE ANALYSIS

The results of factor analysis confirmed to a large degree those of correlation analysis as discussed in Chapter Four above (see factor matrix - Chapter 4 above and Appendix K). It also produced uncorrelated factors or components from the original variables applied to the correlation analysis using MINTAB.

The outcome of this analysis is that it reinforced the earlier findings of the initial analysis of the operative data comparing safety attitudes and safety performance. This indicates beyond doubts that the initial analysis (correlation) are quite acceptable as far as the research is concerned.

However by subjecting the data to Factor Analysis, the primary result revealed that the most prominent (dominant factor) to emerge is that oforganisational factors (variables) as defined in the research model illustrated in Figure 3.7. This result is quite significant as it covers aspects of Organisational Policy, and Industry Norms found to be prevalent in the construction industry (see paragraph 4.7.3 above).

Further exposure of the data to Multiple Regression Analysis using SPSS (see paragraph 4.7.4 and 4.7.5 above) confirmed the most dominant relationship established to be between Industry Norm and Safety Performance. The most predominant factors influencing safety performance being:

a) Age of the workers;
b) Payment systems; particularly bonus, and
c) Organisational policy and management.

5.5 SUMMARY

This Chapter discussed the results of the data analysis described in Chapter Four above. It described the factors or variables most significant to safety performance in the construction industry. Furthermore, it described the pattern of attitudes between operatives and site management and those of site management, contract managers, and safety advisers/officers.

The results showed that the variables detailed in the research model (Figure 3.7) have various degrees of association to safety performance in the construction industry.

Further analysis of the results showed that similarities and differences of attitudes prevailed between operatives and site managers, and that similarities and differences also exist quite significantly amongst site managers, contract managers, and safety advisers. Finally, it showed that operatives' pattern of behaviour were more closely connected to those of site managers and that contract managers' pattern of behaviour was generally more closely connected to those of safety advisers than site managers.

The reasons for the closeness of attitudinal relationships were not investigated as an objective of this study, and as such it was considered safer not to hazard any subjective analysis or guesses. Perhaps future researchers may find it rewarding to look in more detail, the pattern of attitudinal behaviour amongst the research constructs, and then explore reasons for any observed similarities or differences which might be found to exist.

Finally, by applying further analysis, using multivariate analysis, the research succeeded in highlighting the most influential factors driving safety performance in the construction industry. These are:

(1) **Organisational Policy**; and

(2) **Industry Norms.**

CHAPTER SIX

Conclusions, Implications and Recommendations for Further Research

CHAPTER SIX

6 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

6.1 INTRODUCTION

The aims of the Research have been to:

1. Identify the incidence and diversity of the most common source or cause of accidents on construction sites (see Table 4.15 (b) in Appendix)

2. Identify the more common factors associated with safety behaviour in construction workers;

3. Identify where possible, the extent and effects of company safety policy items associated with employee occupation, age, marital status, length of service etc.;

4. Investigate generally, safety behaviour characteristics in relation to employee and organisational variables, such as indicated by the research model (Figure 3.7).

5. Review the theoretical and practical implications of safety attitudes (opinions), and safety performance or accident control in the light of the research findings.

6. Suggest or recommend safety systems and procedures where possible, towards the prevention and control of some of the safety behaviours identified by the research as having a strong correlation with safety performance; and finally,

7. Make recommendation(s) based on the research outcome, for further research.

The first two chapters of this thesis discussed the problem, of health and safety in the construction industry. It highlighted some of the consequences and implications of accident influences upon personal morale, financial and human cost to industry and society. etc.

Chapter Two reviewed past and current literature considered relevant to this study, including some definition of risk, accident details and it also covered broadly the historical development of health and safety at work, and the definition of accidents.

Chapter Three reviewed some past research models, and discussed the framework for this study, including the development of the research model, and its attendant hypotheses.

The variables considered for the research were discussed under eight main headings and detailed in the research model presented in Figure 3.7, described in Chapter Three.

The reviews of past models, the development of the research model and the discussion of the relationship between the identified variables lead to the central hypothesis discussed in 3.4 and 4.5 above, and which was:

Central Hypothesis

"Safety performance is a function of operatives' and management's attitudes and dependant upon safety behavioural and environmental factors in the construction industry."

In turn the central hypothesis lead to the following sub-hypothesis:

1 **Main Sub-Hypothesis - A**

A.1 Safety performance is a function of operatives' personal historical factors (variables) in respect of age, experience, trade or occupation, and training = C1.

A.2 Sub-Hypothesis 2 (C1)
Safety performance is a function of economic factors (variables)
C10 = C4.

A.3 Sub-Hypothesis 3 (C1)
Safety performance is a function of psychological factors (variables)
C10 = C5.

A.4 Sub-Hypothesis 4 (C1)
Safety performance is a function of technical factors (variables)
C10 = C6

A.5. Sub-Hypothesis 5 (C1)
Safety performance is a function of procedural factors (variables)
C10 = C7

A.6. Sub-Hypothesis 6 (C1)
Safety performance is a function of organisational factors (variables)
C10 = C8.

A.7. Sub-Hypothesis 7 (C1)
Safety performance is a function of environmental factors (variables)

C10 = C9

2. **Main Sub-Hypothesis B (C2)**

B.1 Operative attitudes towards behavioural and environmental factors (variables) differ from those of site managers: C1 vs C2.

B.2 Sub-Hypothesis 9 (C2)

Operative attitudes towards psychological factors (variables) differ from those of site managers.

B.3 Sub-Hypothesis 10 (C2)

Operatives attitudes towards procedural factors (variables differ from those of site managers.

B.4 Sub-Hypothesis 11 (C2)

Operative attitudes towards technical factors (variables) differ from those of site managers.

B.5 Sub-Hypothesis 12 (C2)

Operative attitudes towards organisational factors (variables) differ from those of site managers.

B.6 Sub-Hypothesis 13 (C2)

Operative attitudes towards environmental factors (variables) differ from those of site managers.

3. **Main Sub-Hypothesis** C ($C2_a = C2_b = C2_c$)

Site managers' attitudes towards behaviour and environmental factors (variables) differ from those of contract managers and safety advisers etc.

The research Model was applied to 325 constructs or subjects who were based on various sites and working for ten independent companies selected at random, to examine the evidence of the mentioned hypothesis and sub-hypothesis.

These constructs consisted of the following:

i) Operatives (N = 126)
ii) Site Managers (N = 74)
iii) Contract managers (N = 56), and
iv) Safety advisers/officers (N = 55).

Data was collected through interviews (45), and questionnaires, which were administered personally by the author (45), and by postal services (280).

The results of the research hypothesis were based on four objectives measures as thus:

(i) Item analysis applied to the Likert-type questionnaire with results formulated according to respondents' frequency and percentage response;

(ii) Correlation coefficient to test the degrees of association between the research variables;

(iii) Chi-square analysis as a test of significance of the results.

(iv) Multivariate analysis to strengthen (ii) above and to identify primary (dominant) variables (factors) which strongly correlated with safety performance, etc.

The following are the main conclusions drawn from the results of this research:

6.2 TEST FOR MAIN SUB-HYPOTHESIS' A' AND RELATED SUB-HYPOTHESIS:

"Safety performance is a function of operatives' personal historical factors (variables) in respect of age, experience, trade or occupation, and training."

Results of the sub-hypothesis 4.5.1 in Chapter 4 (see Appendix K, and the Literature Reviews of past research support the first proposition of hypothesis A, confirming that operatives' age, experience, trade or occupation and training are the most dominant and prominent personal factors which impact upon safety performance.

The literature reviewed for the study showed that the most significant factors of all accidents relate to the age and experience of the worker (Vernon, (1944), Hale and Hale (1972), Schulzinger (1956), Grew (1958) etc.

C.4 - Economic Factors: were shown to feature significantly towards safety performance as indicated in 4.5.2.

The most prominent indicators were showed to be attitudes towards risk taking induced by the offer of payment of 'danger money' ($p = 0.001$); lack of enthusiasm for banksman training ($p = 0.05$); incentive bonus payment systems ($p = 0$ 001); push for increased productivity ($p = 0.001$) and the provision of safety bonus (refer Table 4.5.2a).

C.5 - Psychological Factors: were showed by the results to be a great source of influence on safety performance (see Table 4.5.3a).

C.6 - Technical Factors: were shown to be significantly associated with safety performance (refer Tables 4.5.4a). The results of the analysis of sub-hypothesis 4, indicated that awareness of safety hazards on site were highly significant in safety performance.

C.7 - Procedural Factors: covered items of safety provision on site for example, protective clothing, equipment, and its correct use; provision of safety booklets or manuals and induction training etc. (refer Table 4.5.5a).

The results shown in this table confirm the relevance and significance of their influence upon safety performance.

C.8 - Results of the analysis showed that **organisation factors** played dominant roles in safety performance in the construction industry (refer Table 5.5.6a). These showed significant scores ranging from p = 0 005 to 0.001 and 0.02 respectively, and confirming their levels of individual relationships.

The most significant factors being worker-management relationships on site; worker-management co-operation on safety matters and others which might impinge on safety; sub-contractor safety behaviour; trade union involvement in safety committees, and workers' perception of company safety efforts (and records). These confirmed sub-hypothesis 6.

C.9 - Finally, **Environmental Factors:** were shown by the results to have a strong relationship towards safety performance (refer Table 4.5.8a).

The most dominant environmental factors were job skills and knowledge of the job in hand (p = 0.001); planned and organised sites (p = 0.001), followed by site conditions being clean and tidy or untidy (0.01) and workers' individual carefulness.

Figure 4.5 shows the established correlation coefficients of operatives' attitudes towards safety performance, leading to confirmation of the main hypothesis A.

The above relationships between operative safety attitudes and safety performance coincides with the findings of Leather (1983), Andriessen (1978), Hinze (1987), Kline (1964), Hale and Hale (1970), Perusse and Hale (1980) etc.

6.3 TEST FOR MAIN SUB-HYPOTHESIS `B' AND THE RELATED SUB-HYPOTHESIS

(see B.1 to B.6 above)

Results of literature reviews in Chapter Two revealed the influence which age, experience and training had on workers in industries generally, and construction in particular.

On the basis of these findings and the similarities of age range between the groups, it can be accepted that similarities exist between the groups as far as those historical factors examined in this study are concerned. The strong association between age, experience, occupation and training of workers and safety performance was confirmed by Vernon (1944), Hale and Hale (1970), Hinze (1987), Churns (1968), Schulzinger (1956), Grew (1958), Haddon, Suchman & Kline (1964), Vant (1986), Abeytunga (1979) etc. This confirms sub-hypothesis B 1. above.

Chi-square results showed significant association indicating that no fundamental differences exist between operatives and site managers as far as economic variables are concerned, except that their goals differed as far as the economic variables examined were concerned (refer Tables in Appendix L) and Chapter 5 above for detailed discussion of results of prominent economic factors.

Similar to the findings of this research, other researchers had found that economic variables influenced workers' safety performance. Shimmin *et al* (1982); Leather (1983); Vant (1986), and hence confirms the sub-hypothesis.

Significant association was found between operatives' and site managers attitudes towards psychological factors, indicating no differences in attitudes between the groups (see Tables in Appendix L).

Results of chi-square analysis discussed in Chapter 5 above and, findings of other researchers discussed in the literature reviews in Chapter Two confirmed the findings of this research. Such works include Hale & Perusse (1980); Shimmin *et al* (1982), Andriessen (1978), Leather (1983). This confirms sub-hypothesis B.2 as valid.

The results of chi-square analysis showed that there was no difference between operatives' and site managers' attitudes towards procedural factors and thus confirms the proposition of sub-hypothesis B.3 above.

Similar to the results of sub-hypothesis B.3 above, there were no differences between operatives' and site managers' attitudes towards technical factors (see Tables in Appendix L).

Similar findings by Apau (1980) showed that there was strong association between the technical factors examined in this research, and hence confirms the research findings, for sub-hypothesis B.4 above.

Organisation factors were found to have strong association with safety performance by results of correlation coefficient analysis and chi-square test of significance (refer Tables in Appendix L).

Chi-square tests also showed that there was no difference between attitudes of operatives and site managers towards the organisational factors examined in this study (refer Tables of results in Appendix L), and discussions in Chapter 5 above.

It might be important to note that similar findings were attained by Hinze (1978), Hill and Trist (1953), Andriessen (1978), Leather (1983), HSE Report (1976). These results provide ample confirmation for the proposition contained in sub-hypothesis B.5 above.

Three main factors in particular were identified as having strong association to safety performance as far as environmental factors were concerned according to the results of chi-square analysis (see Tables in Appendix L).

These were:

(i) The influence of site conditions upon safety performance was dependent upon whether the site was untidy or clean; untidy sites caused more accidents, and clean sites might reduce accidents.

(ii) Good job planning and properly organised sites, and

(iii) The safety behaviour of workers as to whether they know their jobs and were thoughtful of the way they performed their jobs.

Sites which were well planned (layout) and had good organisations were found to be more likely to have less accidents than those which were not, and finally workers who knew their jobs and performed their tasks more confidently and provided they were thoughtful of the way they carried out these tasks on site, were less likely to suffer accidents (see Tables of results in Appendix L)

Similar findings were achieved by Leather (1987), Apau (1980) etc., as discussed in the literature reviews in Chapter Two above. These results confirmed the findings of this research.

6.4 TEST FOR MAIN SUB-HYPOTHESIS 'C' AND RELATED SUB-HYPOTHESIS:

(Refer 4 7.1. (Chapter 4); sub-sections 14.1 to 14.8 - null hypothesis), and 5.3 (Chapter 5), paras. a, b, c, d, e, f, g and H - discussion of results testing main sub-hypothesis C, which states that:

C.1 Attitudes of site managers towards behavioural and environmental factors (variables) differ from those of contract managers and safety advisers etc.: C2a vs C2b vs C2c.

C.2. **Sub-hypothesis 14a:** site managers attitudes towards historical factors differ from those of contract managers and safety advisers.

C.3 **Sub-Hypothesis 15.b:** Site managers' attitudes towards economic factors differ from those of contract managers and safety advisers.

C.4 **Sub-Hypothesis 16c:** Site managers' attitudes towards psychological factors differ from those of contract managers, and safety advisers.

C5 **Sub-Hypothesis 17c:** Site managers' attitudes towards procedural factors differ from those of contract managers and safety advisers

C.6 **Sub-Hypothesis 18c:** Site managers' attitudes towards technical factors differ from those of contract managers and safety advisers.

C.7 **Sub-Hypothesis 18c:** Site managers' attitudes towards organisation factors differ from those of contract managers and safety advisers

C.8 **Sub-Hypothesis 19c:** Site managers' attitudes towards environmental factors differ from those of contract managers and safety advisers

C.9 **Sub-Hypothesis 20c:** Site managers' attitudes towards safety performance factors differ from those of contract managers and safety advisers.

The above sub-hypotheses labelled C.1. to C.9. were devised to test the main sub-hypothesis C, to validate or otherwise the proposition that "site managers' attitudes towards behavioural and environmental factors (variables) differ from those of contract managers and safety advisers etc."

Examination of the results of chi-square analysis as contained in Tables detailed in Appendix M) and discussed in Section 5.3 (a-h) above, demonstrates that there are significant similarities and differences in attitudes towards the listed variables between site managers, and contract managers and safety advisers.

This means that the results of the tests are inconclusive, although it is evidenced that there are more similarities in attitudes amongst the groups than there were differences between them.

Despite the mixed outcome, the overall results showed that contract managers attitudes were found to be closer to those of safety advisers than with site managers (refer Tables).

Finally, result of multivariate analysis confirmed organisational policy, and industry norms (including payment systems) to be the most dominant factors influencing safety performance.

However, it is important to note that the chi-square test used for comparing the behaviour patterns of operatives, site managers, contract managers and safety advisers, may be inadequate for a research work of this importance or level. It was also very time-consuming as several stages of data manipulation were undertaken, before a final analysis was achieved Perhaps a multi-dimensional or cluster analysis technique might have proved more useful and conclusive in terms of the findings achieved for that section of the research.

6.5 GENERAL CONCLUSIONS

Probably the most plausible conclusion which must be reached from this brief review of the research hypotheses is that the results of this research were far more complex than was originally envisaged. Thus in retrospect, the hypotheses appeared to have over-simplified the results.

The hypotheses, it would be remembered, were formulated following an in-depth review of other studies of the safety and risk fields as discussed in Chapters Two and Three above.

If the hypotheses were incorrect, or over-simplified, it was either because the in-depth review of past literature and studies was not conducted systematically enough, or because the empirical evidence available from those previous studies reviewed was incomplete, or had not reached a well-developed stage to be directly relevant to this study.

The possibility that the analysis of the past studies was not systematic enough, or not fully developed at the time, cannot be rejected altogether. There are however, indications that some of the outcomes of the models reviewed in Chapter Three were not completely relevant to this study, and were thus unreliable as far as this research aim was concerned. For instance, when those models were discussed, a number of methodological short-comings were indicated in each of the studies reviewed, except those of Abeytunga (1979); Hale and Hale (1972), Darwish (1987) and Leather (1983). Furthermore, in the light of the results of this research, a number of further shortcomings can be indicated, which were not too obvious at the time.

For example, by restricting their data collection to only one sample, the researcherswhose studies were reviewed in Chapter Three, each applied only one list of elements. Since this list had varied from one study to the other, and most probably as a result of the levels of homogeneity amongst elements varied from one list to another, some aspects of the research outcomes differed from one study to the other. The results of this research however, suggest that safety attitudes and safety performance factors involved more complex mechanisms.

Two of the studies reviewed in Chapters Three (Leather, 1983; and Darwish, 1987) had relied mainly on the use of Likert-scale instruments to collect data, and then subjected the data collected to measures of frequency, percentage, and correlation analysis. The results of this research suggest that Likert-scales, frequency/percentage measures and correlation analyses were fairly accurate methods of summing-up the main trends within a sample, since the correlation analysis outcome were generally confirmed by the multivariate analysis.

However, the model derived from the review of past studies, and which was used for this research suggests that the three key elements of the research model, that is, the "safety attitude retainers" (the research subjects), the "attitude generators" (the safety attitude factors), and the safety performance factors, were inter-related. This is substantiated by studies by Leather (1983), Darwish (1987), Hale and Hale (1972) etc., where the key elements had similar significant constructs.

There are indications therefore, that the model proposed in Chapter 3, though simple, does encompass results from other studies (Leather,(1983), Andreisson, (1978), HSE, APAU 1976) etc., as well as the results of the research. The model could most probably serve as a very useful basis for future research. However, apart from some similarities with some elements of safety attitudesin Leather (1983), Darwish (1987), there is nothing in the model which compared to other models reviewed in Chapter 3. Nevertheless, outcomes from Leather (1983) indicated relationships did exist between -

Inputs (which were individual orientation to safety, inter- and intra-group relations, and organisational management style and practice);

PAS (Potential Accident Subject);

Outputs (Attitude Behaviour), and

Accident and Feedback (training needs, legal sanctions and organisational changes).

Leather postulated that all the above elements were monitored by self (the individual), workmates, safety officers/reps, management, and outside agencies (HSE etc.), all bear similarities to the model of this research (refer: Fig 3.8, p93 above). In any case, consideration of all the shortcomings and differentiations which exist between the models reviewed, and the model for this research, as discussed above, only one thing was certain - and that is further research is needed in order to define some aspects of the model more precisely. Such a research would require a model which was not too simple and straightforward, as this research model. A revised model would therefore be necessary. It is suggested that such a model ought to include, amongst the elements for investigation, the client's input or influence upon safety, and more broad safety performance factors than accident records and near-misses. Such a model it is believed, would produce more detailed hypotheses, and null hypotheses, that would aid further clarification or understanding of the relationships between safety attitudes and safety performance.

6.6 SUGGESTIONS FOR FURTHER RESEARCH

There are many potential areas for future research. For example, as pointed out earlier, some aspects of the model for this research remained to be tested, and other aspects need to be formulated in more specific terms. There are also more detailed behavioural implications for any research of this kind, and of such a complex phenomenon such as safety attitudes/behaviour, and safety performance. It might prove very useful to investigate these implications. These potential areas for further research are discussed separately in this section, including a proposed revised model shown in below.

6.6.1 Research on the Model

It was *mentioned in Chapter 3, that many other possible analytical approaches prevailed*, any of which could be applied to the data analysis. Since the model postulates different levels of generality (or conversely, of specificity), it might be useful to consider whether these different levels correspond to different strengths of correlation. Principal component analysis performed on component scores would be one way of investigating the various levels of generality or specificity or even of differentiated considerations, rather than the use of item-analysis. Likert-type scaled questionnaires could still be used for collecting the data for the study, but for one sample type only. For example, "operative attitudes to safety on site" (as carried out by Leather (1983), or "client's safety attitudes and their relationships to effects on safety performance", or even "safety officers' attitudes to safety performance".

Investigating only one sample at a time may be possible to conduct a "before" and "after" study on the one simple on a set of chosen sites, over a period of about two years.

Cluster analysis, and multi-dimensional scaling methods could be used to analyse the data, again collected via "Likert-scale" instrument.

Other strategies could also prove to be worthwhile. For example, "critical incident techniques" as suggested by Tarrant, (1970), could be used to test the safety temperature, on selected sites as utilised by Leather (1983), and might throw some more light on the outcome of Leather's model for operatives' study, and on the model proposed for this research.

Throughout this research, a number of individual characteristics of respondents and features of the industry, which were different between samples have been indicated. Age, sex, education, craft, trade or professional background, marital status, knowledge and experience in health and safety matters, pay systems etc., were all respondent and industry characteristics, on which samples differed. There were also differences between the operative safety performance grids and those of management used in the four samples (i.e., operatives, site managers, contract managers, and safety officers/advisers).

This research was not designed to rigorously control these variables. Different experimental designs would be needed in order to perform a more systematic test of the potential influences of these variables. Nevertheless, the comparisons executed have shown the potential influences which exist between safety attitudes, and safety performance as discussed in Chapters Four and Five above. Notwithstanding the achievements of this research so far, the author believes that the data at hand could be submitted to more stringent analysis by looking at the opposite hypotheses, or null-hypotheses. It is possible that such analyses might shed more light on the research outcome so far achieved. A possible research model is also introduced as a suggestion to aid future research thinking (see Fig 6.1).

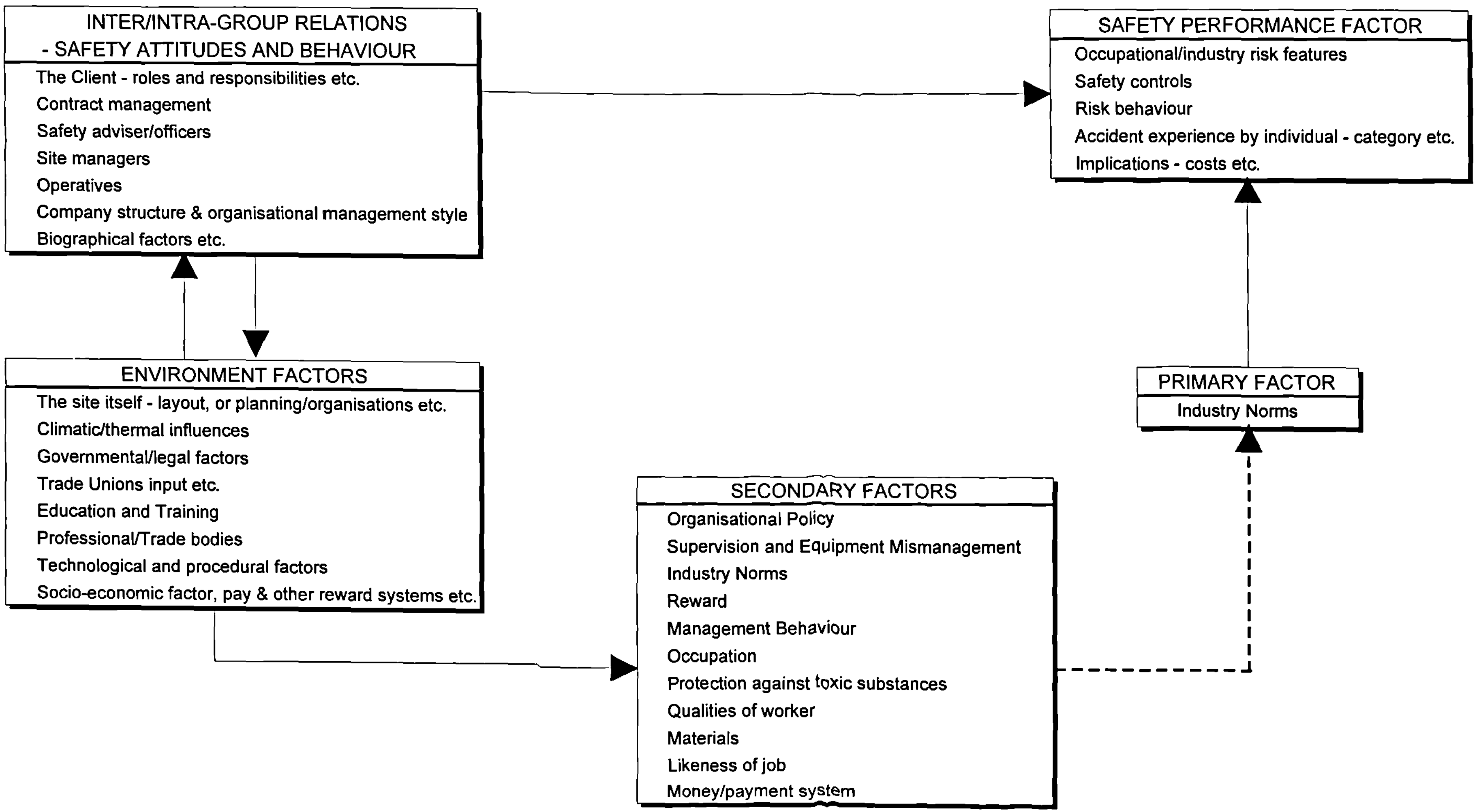


Figure 6.1: A REVISED MODEL

6.7 RESEARCH IMPLICATIONS

This research study has some interesting implications for client/client representatives, for safety practitioners, operatives and Trade Union officers, management in the industry, and all those interested in research concerning the safety behaviour aspects of the construction industry.

(a) For instance, the research has shown that safety-conscious contractors are disadvantaged as result of current tendering systems, formulated in the main by clients and their advisers without serious concern for safety organisation in the work situation. It suggests that for industry to safeguard the safety-conscious contractor, the client must ensure that safety administration is accounted for in the final successful tender bid. It proposes that allowing a percentage sum for safety organisation at tender stage will force all tenderers to consider pricing for safety in their final bid, and that the client must have the opportunity of enforcing it in the contract.

(b) Safety practitioners must therefore be drawn into the tendering team of the contracting firm to give safety advice. Their role will be to ensure that all aspects of safety requirements are considered, and priced for in the firm's tender bid. Such a bid if successful, would have allowed adequately for financing safety without elaborately cutting the cost of safety to ensure profitability. Research subjects are all unanimous that alcohol and drug policies were now necessary in the industry, and this view has implications for the policy makers etc.

(c) Operatives and Trade Unions etc. must play an effective role in ensuring that workers tow the line as far as compliance with all aspects of safety requirements on site are concerned, including mandatory use of safety protective clothing/equipment, and avoiding unnecessary risk-taking, or acts of carelessness etc. Employees must realise that working safely really helps to reduce the number of accidents, and that the safety promoting site manager or supervisor influences worker safety awareness.

(d) Management must realise that they alone cannot ensure total safety provisions on site, without the establishment of good relationships with operatives, Unions, their safety officers, sub-contractors, and other parties for the construction process.

The research has shown that poor co-operation between members of the construction team, and poor co-ordination of safety, particularly on multi-occupied sites has serious consequences for safety performance. As such, this finding has serious implications for all those who may have responsibility for the co-ordination of sub-contractors' work, or work of other groups of workers on small, medium and large sites. It is also important to promote the essence of safety*via* the group, including the supervisor, with discussions or communications playing a vital part.

(e) Pay systems and reward systems, that is, productivity bonus payments encourage some degree of chance-taking in order to get the job done quickly, and to enhance earnings. Similarly, jobs with high bonus systems requiring urgent programme completion, may motivate supervisors and site managers to turn a 'blind eye' to safety hazards, which may or may not lead to accident occurrence. As a remedy, the research indicates that safe-working and productivity must go hand-in-hand, and that this can be achieved by the implementation of reward systems that compensate the worker for safe-working and achieving the desired levels of production. In other words, an incentive for safe working must be devised by management and work study practitioners. Interestingly, the longitudinal study revealed that most companies in the sample already make such awards or rewards.

(f) For the industry, construction companies must recognise that their most valuable asset is their human resource: as such they need to be maintained and updated like machines (etc.), by regular skills and safety training, and health and safety updates *via* in-company and on-site safety communication. Companies must invest expeditiously in health and safety, and skills, as these bear significant relationships to good safety performance and company profits.

(g) Finally, it cannot be stated at present whether the safety attitudes dimension in the construction field can develop into a stable mechanism or not. There may be a parallel worth investigating between attitude formation and attitude change on the one hand, and safety performance mechanism on the other. Currently, there are indications too, that safety education and training of site managers is inadequate for them to carry out efficient safety inspections on site. If this research indication is acceptable, and since the research indicated that twenty-eight percent (28%) of site managers are University graduates, and twenty-three percent (23%) technical college-educated, it might be worthwhile finding out whether training or tuition in health and safety bring about a change in safety behaviour. For instance, the hypothesis can be postulated that, "University/technical college health and safety courses or curriculum is inadequate for promoting safety performance on site". A "before" and "after" study could be undertaken of undergraduates and students of construction during attendance at college, and on starting work on site for one year or more.

6.8 THE RESEARCH LIMITATION

The main limitation of this research apart from those shortcoming of the research model discussed above, is the difference in design between aspects of the operative questionnaire and those of site managers, contract manager and safety advisers, etc.

For example, operative questionnaire was designed to determine operative accident experienced as a measure of safety performance; whereas, those of management did not have such a provision. A more direct comparison of safety performance and safety attitudes between operatives and managers, or between site managers and contract managers/safety advisers would have been more probable, and may be seen to have more immediate benefit to the practising managers or advisors in the construction industry.

Notwithstanding the above, since the current research findings generally correspond with those of other research studies discussed in this thesis, the chosen hypothesis are considered valid.

However, it is suggested that future researchers who wish to build upon this work should take note of this limitation, or any others they choose to find in the body of the work.

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APPENDICES

LETTERS

APPENDIX A

BRUNEL UNIVERSITY
Uxbridge Middlesex UB8 3PH
Telephone: 0895 37188 Ext. 713

Department of Mechanical Engineering
incorporating the
Division of Building Technology
and the Construction Study Unit
Head of Department: Professor A.J. Reynolds

EOOS/PM

Dear Sir,

Research into - Safety Attitudes and Safety Performance in the Construction Industry

Just over two years ago, you and your organisation contributed immensely towards the successful conduct of a research project into 'Operative's/ Management attitudes towards Safety Representatives and Safety Committees, in the Construction Industry'. During that time, some of you assisted in the distribution and collection of questionnaires on our behalf, which were designed to survey Management and Operative's attitudes; others took part in structure of interviews - all of which helped to achieve some tentative conclusions, namely; that:-

(a) - a relationship exists between expressed attitudes of Operatives/Management, and accident occurrence in the construction industry,

(b) - that Operatives' and Management attitudes towards Safety Representatives were highly favourable, and

(c) - that Operatives and Management have ambivalent attitudes towards safety committees.

In view of these encouraging results, a further two year in-depth study to compare 'safety attitudes with safety performance in the Construction Industry' is now being undertaken.

Since you have indicated that you would be willing to co-operate in any future research of this kind, I am now writing to you, officially, to request your continued assistance in furthering the aims and objectives of this research. Should you wish me to visit your organisation at this early stage of the research to discuss matters of mutual interest or to ascertain what sort of help you could offer, I would be pleased to hear from you to that effect.

However, I would be grateful if you could indicate your continuing willingness to assist with this study.

A copy of detailed summary findings and conclusions will be sent to all individuals/organisations who co-operated with the study, at the end of the research.

I look forward to hearing from you soon.

Yours faithfully,

Edwin Sawacha

BRUNEL UNIVERSITY
Uxbridge Middlesex UB8 3PH
Telephone: 0895 37188 Ext. 713

Department of Mechanical Engineering
incorporating the
Division of Building Technology
and the Construction Study Unit
Head of Department: Professor A.J. Reynolds

EOOS/PM

November 1984

Dear Sir,

<u>Research into - Safety Attitudes and Safety Performance in the Construction Industry</u>

I am currently engaged in a two year research programme leading to the degree of Doctor of Philosophy in the above subject matter.

As the research is at a relatively early stage, I would appreciate it if you could circulate the staff of your department/organisation with this letter and encourage any who have similar interests to contact me. Obviously, I do not wish to stray into fields which are already being researched and so any feedback from this letter would be much appreciated, as would any opportunities for collaboration.

I am particularly interested in the fields of construction safety and safety performance, (in Building and Civil Engineering, Building Services Engineering, and generally in all aspects of Safety, Planning, Education and Training, Organisation and Management).

Any interested researchers, Safety Consultants, Safety Officers, Contract/Construction Site Managers, etc. with an interest in safety generally and particularly in safety attitudes and performance can contact me at the above address for a more detailed exchange of information and/or discussion of the research objectives, methods and any ideas of mutual interest in such research areas.

Yours faithfully,

Edwin O.O. Sawacha

Brunel
THE UNIVERSITY OF WEST LONDON

Uxbridge, Middlesex UB8 3PH
United Kingdom
Telephone Uxbridge (0895) 74000
Telex 261173 G

Department of Mechanical Engineering
Head of Department: Professor A.J. Reynolds

Dear Sir

Re: Research into "Safety Attitudes and Safety Performance" in the UK Construction Industry

I am writing to thank you and your staff for the immense effort and time which you have put into helping to make data available for this research.

Your overall assistance and contributions to the research are mostly invaluable, and I am personally grateful to you. Data is now being analysed, and when completed, a copy of the summary findings will be made available to you for information.

Thank you so much for your continued co-operation. If you have any further information or ideas to contribute to the research, you are most welcome to do so.

Yours sincerely,

Edwin Sawacha.

UMIST

The University of Manchester Institute of Science and Technology
PO Box 88, Manchester M60 1QD, United Kingdom
Telephone 061-236 3311
Telex 666094

ARD/SFR

DEPARTMENT OF BUILDING

15 January 1985

Mr Edwin O O Sawacha
Department of Mechanical Engineering
Brunel University
Uxbridge
Middlesex
UB8 3PH

Dear Mr Sawacha

A colleague and I have recently made an application to the SERC for a research grant to cover work in the area of behaviour/motivation on construction sites. This is to be particularly directed towards wastage of building materials but will have implications for attitudes to site safety and to quality control.

Perhaps you could contact me in April, by which time we shall know whether the research is to proceed.

Yours sincerely

A. Roy Duff

DR A R DUFF
Lecturer in Building

UNIVERSITY OF YORK

THE INSTITUTE OF ADVANCED ARCHITECTURAL STUDIES

THE KING'S MANOR, YORK
YO1 2EP Tel. 0904 24919

5 February 1985

Dear Mr Sawacha

Thank you for your letter of the 1 February 1985.

I regret we are not able to help you as we have not undertaken any work on the problems of construction safety and safety performance.

I am also at a loss to recommend contacts, but I would have thought the Chartered Institute of Building would be the obvious one.

Yours sincerely

Douglass Wise

~~PROFESSOR~~ DOUGLASS WISE
DIRECTOR

Mr Edwin O O Sawacha
Dept of Mechanical Engineering
Brunel University
Uxbridge
Middlesex UB8 3PH

DW/jeh

Director Professor **Douglass Wise** OBE BArch DipTP RIBA   Assistant Director **Stuart Sutcliffe** RIBA   Secretary **Joan Harris**
Radcliffe Reader in Architectural History and Conservation **Derek Linstrum** DipArch PhD FSA RIBA   Librarian **Keith Parker** BA ALA
Research Director **Jeremy Taylor** MA PhD RIBA   Photogrammetric Unit: Chief Surveyor **Ross Dallas** BSc

Health & Safety Executive

London South Area
1 Long Lane
London
SE1 4PG
Telephone 01-407 8911

Mr E C C Sawacha
Department of Mechanical Engineering
Brunel University
Uxbridge
Middlesex
UB8 3PH

Your reference

Our reference

Date 28 MAY 85

Dear Mr Sawacha

I am replying to your recent letter addressed to Mr Fountain which has been passed to me for reply.

Might I suggest that you consider two sources of information for your research.

1. The Construction Sectór Report for 1981-1982 contains bibliographic and historical data about the Industry. A copy is enclosed.

2. A fuller, and more up-to-date list of HSE publications is contained in the Publications in series list, for January 1985, a copy of which is enclosed.

I hope these will be of use to you, and I wish you well in your thesis.

Yours sincerely

AN ROBERTSON
M Inspector of Factories

DEPARTMENT OF ENGINEERING

UNIVERSITY OF WARWICK
COVENTRY CV4 7AL

TELEPHONE COVENTRY (0203) 24011

In reply please quote: BGB/ht

11 February 1985

Mr. Edwin O.O. Sawacha
Department of Mechanical Engineering
Division of Building Technology and
Construction Study Unit
Brunel University
Uxbridge
Middx UB8 3PH

Dear Mr. Sawacha

Research into Safety Attitudes & Safety Performance in the Construction Industry

Your letter of the 4th February 1985 has been passed on to me for comment.

I read with interest your ambitious aims of researching into a particularly difficult and politically sensitive field. I and members at Birmingham University (Messrs Seymour and Birch at the Department of Transportation) are indeed interested in this topic, Our main concern at the moment being the quality and safety standards of Falsework and Formwork construction and the implications for the management organisation(s). I (we) would be pleased to discuss with you issues arising from your research, perhaps in the not too distant future when your objectives are clarified and research is proceeding.

Yours sincerely,

Bryan Burrows.

THE UNIVERSITY OF SHEFFIELD

HEAD OF DEPARTMENT

PROFESSOR T. H. HANNA
B.Sc., Ph.D., C.Eng., F.I.C.E.
TEL. 0742 78555 EXT. 5053 & 5061
TELEX UL SHEF G 54348

DEPARTMENT OF CIVIL AND
STRUCTURAL ENGINEERING
THE UNIVERSITY,
MAPPIN STREET,
SHEFFIELD.
S1 3JD

THH/SM

11 February 1985

Mr Edwin O O Sawacha
Department of Mechanical Engineering
Brunel University
Uxbridge
Middlesex
UB8 3PH

Dear Mr Sawacha

Thank you for your letter of 4 February concerning your research into safety attitudes and safety performance in the construction industry. I am afraid that there are no members of staff in this Department directly involved in research of this nature. We give a few lectures to our undergraduate students in certain aspects of safety on construction sites. I think your best approach is to have discussions with all the major contracting organisations in the UK. You might also write to the Secretary of the Institution of Civil Engineers. As you will be aware, there was a committee headed by Lord Penny looking into certain aspects of structural safety. I think that would be your best starting point if you have not already done so.

Yours sincerely,

T H Hanna

Department of
Civil Engineering

Rankine Building,
The University,
Glasgow G12 8LT
Tel: 041-339 8855 Ext. 7211

13th February, 1985.

Mr. Edwin O. O. Sawacha,
Department of Mechanical Engineering,
Brunel University,
UXBRIDGE,
Middlesex,
UB8 3PH.

Dear Mr. Sawacha,

<u>Safety Research</u>

I refer to your letter of 1st February addressed to the Head of the Department of Civil Engineering and enquiring about staff interested in safety research. Professor H. B. Sutherland has asked me to reply to your letter.

I regret that, at present, there is no one in the Department who takes an active interest in Safety Research.

Yours sincerely,

Dr. I. McConnochie,
Lecturer in Civil Engineering.

University of Durham Department of Engineering

Science Laboratories, South Road,
Durham, DH1 3LE, England
Telephone: Durham 64971 (STD code 0385)

Ref: ARS/CW

14th February, 1985

Mr. E.O.O. Sawacha,
Department of Mechanical Engineering,
Brunel University,
Uxbridge,
Middlesex.
UB8 3PH

Dear Mr. Sawacha,

I regret that we do not teach specifically towards safety in the construction industry, except that our introduction to management course includes material on health and safety at work and the factory inspectorate. No member of staff is involved in research into construction safety.

Yours sinerely,

AR Selby

Dr. A. R. Selby

THE POLYTECHNIC OF WALES
POLITECHNIG CYMRU

Director J. D. Davies
OBE, MSc, PhD, DSc, CEng, FICE, FIStructE

**Department of
Civil Engineering and Building**

Head of Department
R. D. McMurray BSc, CEng, FICE, FCIOB

Pontypridd Mid Glamorgan CF37 1DL
Telephone (0443) 405133

Mr. E. O. O. Sawacha,
Department of Mechanical Engineering,
Brunel University,
Uxbridge,
Middlesex UB8 3PH.

Date: 14th February 1985.
Our ref: Ec/GOR/KM

Dear Mr. Sawacha,

Research into - Safety Attitudes and Safety Performance in the Construction Industry

With regard to your letter of 4th February, it is regretted that there are no research ongoing projects in the Department dealing specifically with safety in the construction industry at the present time.

A copy of the Polytechnic Research Report for 1981-83 is enclosed which you might find of interest.

Yours sincerely,

R D McMurray

Hg/R. D. McMurray
Head of Department

THE UNIVERSITY
OF ASTON
IN BIRMINGHAM

Gosta Green, Birmingham B4 7ET/Tel: 021. 359 3611 Ex

Department of Civil Engineering and Construction

Edwin O.O. Sawacha, Esq.,
Department of Mechanical Engineering,
Brunel University,
Uxbridge,
Middlesex UB8 3PH.

15th February, 1985

Dear Edwin,

Safety Attitudes and Safety Performance

No-one at Aston is delving into your field at the moment. You will know that the problem is one of confidentiality - because events which hazard individuals may carry with them legal liability. Safety performance therefore attracts little cooperation at the shop floor of the industry. I have had final year students in recent years who created their own check list of visible departures from safety standards (go through the RoSPA handbook). They then compiled statistics about the degree of nonconformity by sampling sites. The outcome is not complimentary to the industry. The conclusion was that enforcement is not sufficiently well manned nor were penalties sufficiently high to encourage self-regulation.

I think, however, that in aspects of character and attitude (neither of which is directly connected with liability) you may strike a rich vein. Brunel is experimenting with psychoanalytical classification. Attitude surveys, given good guidance, can be very productive procedures. Is an accident prone individual identifiable? Does the attitude to safety change in the face of some dangerous event? You might, over two years, be able to do a "before and after" study somewhere within your catchment.

Investigate how much safe working is inducted during craft training. After all sound norms of behaviour create a sound climate for work.

Best regards,

Professor W.B. Jepson

University of Bath

E Happold
Professor of Building Engineering
M Brawne
Professor of Architecture
P Smithson
Part-time Professor of Architecture

School of Architecture
and Building Engineering
Claverton Down
Bath BA2 7AY
Tel: (0225) 61244
Telex 449097

18 February 1985

E O O Sawacha Esq
Department of Mechanical Engineering
Brunel University
Uxbridge
Middlesex UB8 3PH

Dear Mr Sawacha

Thank you for your letter of 1 February 1985.

It is true that we do a little teaching about safety attitudes and performance in the construction industry but I am afraid nobody is researching into that field.

I am sorry I cannot be of more help but I hope that your investigations are successful.

Yours sincerely

pp EDMUND HAPPOLD

University of Strathclyde

Department of Civil Engineering

John Anderson Building,
107 Rottenrow, Glasgow G4 ONG Tel: 041-552 4400 Ext.

Mr. Edwin O.O. Sawacha,
Department of Mechanical Engineering,
Brunel University,
Uxbridge,
Middlesex, UB8 3PH.

19th February, 1985.

Dear Mr. Sawacha,

Research into - Safety Attitudes and Safety Performance in the Construction Industry

Your letter dated 4th February 1985 has been passed on to me by the Chairman of our Civil Engineering Department.

Although I do have an interest in Safety on Construction Sites from both a Construction and Management viewpoint I am afraid that I am not able to offer you any further help in this instance. As far as I am aware very little academic research has been carried out in this area, although some attempts have been made by non-engineers.

I wish you well in your endeavours.

Yours sincerely,

A.A.R. Stanbury

University of Ulster at Jordanstown

Shore Road Newtownabbey Co. Antrim BT37 0QB Northern Ireland
Telephone Whiteabbey (0231) 65131 Telex 747493

Department of Building.

HH/KW

26 February, 1985.

E. O. O. Sawacha, Esq.,
Department of Mechanical Engineering,
Brunel University,
Uxbridge
Middlesex
UB8 3PH.

Dear Sir,

With reference to your letter of 4th February, I would like to inform you that we do not have any research in this field in progress at present. However, I would suggest that you contact:

Mr. W. Lambe
Safety and Administrative Officer
The Federation of Building and
Civil Engineering Contractors (N.I.) Ltd.,
143, Malone Road,
BELFAST
BT9 6SU.

Wishing you success with your research.

Yours faithfully,

HAROLD HARVEY.

THE ADVANCED BUSINESS CENTRE UNIVERSITY OF NOTTINGHAM STUDY GROUP

PAL RESEARCHER
'HILIP J. LEATHER
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Ir. Edwin O. O. Sawacha,
Jept. of Mechanical Engineering,
Irunel University,
Ixbridge,
Iiddlesex UB8 3PH

8th March 1985

Jear Mr. Sawacha

Research into Safety Attitudes and Safety Performance in the Constructio
Industry

'rofessor Shimmin has passed on to me the letter you sent to her - or at least which she received - earlier this year. I was formerly n the Dept. of Behaviour in Organisations, at Lancaster, before aking up my present appointment here in Nottingham.

'or a number of years I have been working on "attitudes to safety in the onstruction industry", although I would not go so far as to say that am an "expert" on the subject. For an idea of where this work has een leading me you might usefully have a look at Construction News. hursday December 15, 1983 pp. 12 and 16. There is an article there hich reports on some of my findings. Alternatively, you might look t a copy of the Proceedings of the Annual Conference of the Aston Iealth and Safety Society, 29th October 1983 (held in Birmingham). 'ou may need to contact the University of Aston to obtain this latter eference.

do have a number of more substantial papers in the pipeline, but hey are not published yet.

Iiven the complexity of the subject, and also of my own thoughts on it, cannot see how I can be of any further help to you unless either 1) you can let me know a little more specifically what you are ooking for, or (2) you could come up to Nottingham for a chat. I ould be only too prepared to help you if you could manage either.

'ours faithfully Philip J. Leather Dr. Philip J. Leather

The University of Birmingham

DEPARTMENT OF CIVIL ENGINEERING
The University of Birmingham, P.O. Box 363, Birmingham B15 2TT
Telephone 021-472 1301

M. J. Hamlin, BSc, DIC, MSAICE, FIWE, Professor of Water Engineering and Head of Department
W. H. Wittrick, ScD, MICE, FRAeS, FAA, FRS, Beale Professor of Civil Engineering
B. P. Hughes, DSc, FIStructE, MICE, Professor of Civil Engineering

Our Ref:- MJH/GDR
Your Ref:- EOOS/PM

21st March 1985

Mr. E.O.O. Sawacha,
Department of Mechanical Engineering,
Brunel University,
Uxbridge,
Middlesex. UB8 3PH

Dear Mr. Sawacha,

Research into safety attitudes and safety performance in the construction industry

I have circulated your letter dated the 4th February to a number of my colleagues. Mr. D.E. Seymour would be willing to talk to you about falsework research and if you have any interest in this area perhaps you would write to him at this address.

Yours sincerely,

M.J. Hamlin

Professor M.J. Hamlin.

c.c. Mr. D.E. Seymour.

The Federation of Building and Civil Engineering Contractors (Northern Ireland) Ltd.

Telephone: Belfast 661711

Director
Gordon Burnison, LL.B., F.C.I.S., F.C.I.Arb.
Barrister at Law.

143 Malone Road,
Belfast,
BT9 6SU

Our Ref: AWL/hb

16th May, 1985

For the attention of Mr. E. O. O. Sawacha,
Department of Mechanical Engineering.

Dear Mr. Sawacha,

Further to your letter of 10th May, 1985, I now have pleasure in attaching the Annual Report for 1984 in respect of the Federation.

I have taken the opportunity of circulating your brief paper which gives an insight into the background and scope of the Research intentions to approximately seven or eight firms in the Construction Industry whom I know have got Safety Officers.

I trust that they will be of some assistance to you.

Yours sincerely,

A. W. Lambe,
Safety & Administrative Officer.

Brunel University,
Uxbridge,
Middlesex,
UB8 3PH.

Enc.

Health & Safety Executive

Magdalen House
Stanley Precinct
Bootle L20 3QZ
Merseyside

Telephone Direct Line 051-951
Switchboard 051-951 4000

Mr E Sawacha
Brunel University
Dept of Mechanical Engineering
Uxbridge
Middlesex
UB8 3PH

Your reference

Our reference

Date 16 May 1985

Dear Mr Sawacha,

SAFETY ATTITUDES AND SAFETY PERFORMANCE IN CONSTRUCTION

Thank you for your letter of 9 May 1985 informing me of the research you are conducting into this subject. I look forward to reading your findings but I doubt whether I am the most appropriate person in HSE to give you the type of help you may require. A better contact for you might be Mr Bernard Freeman who is the Chairman of the CONIAC Attitudes Working Party and is the HSE National Industry Group Leader for Construction. I have passed your letter to him for a substantive reply on historical data, relevant literature and accident statistics and I wish you every success in your research project.

Yours sincerely,

M A Fountain

M A FOUNTAIN
FI6

UMIST

The University of Manchester Institute of Science and Technology
PO Box 88, Manchester M60 1QD, United Kingdom
Telephone 061-236 3311
Telex 666094

ARD/SFR

DEPARTMENT OF BUILDING

30 May 1985

Mr E O O Sawacha
Dept of Mechanical Engineering
Brunel University
Uxbridge
Middlesex
UB8 3PH

Dear Mr Sawacha

Thank you for your letter of 23 May. Unfortunately we have not been successful in obtaining funds from SERC to support our research into behaviour modification on construction sites. There is, however, I am told a good chance that a further application similar to the last but with some slight modifications would be successful in obtaining the necessary funds.

I shall, in spite of the delay to our own research activity, be happy to discuss any aspects of your research you feel would be useful. You might be interested in attending a meeting of a Special Interest Group of the Association of Researchers in Construction Management which is due to take place at UMIST in July. Mr Newcombe, Mr Langford and Mr Rowlinson have all been circulated with details of this meeting and you can obtain these from them if you wish. You would, presumably, be expected to become a member of the Association in order to attend this meeting but this is not an expensive item. In this way you would not only be able to discuss your research with me but also be making contact with several other researchers in the field of human performance.

If, however, you would prefer a discussion just between ourselves then please feel free to ring me and make such an arrangement for any convenient time.

Yours sincerely

A. Roy Duff

DR A R DUFF

UNIVERSITY OF OXFORD

DEPARTMENT OF ENGINEERING SCIENCE

PARKS ROAD · OXFORD · OX1 3PJ · TELEPHONE (0865) 59988

Head of Department: C. P. WROTH, M.A., D.Sc., F.Eng., M.I.C.E., Professor of Engineering Science

CPW/JFB

15th August 1985

Mr. E. O. O. Sawacha
Department of Mechanical Engineering
Brunel University
Uxbridge
Middx UB8 3PH

Dear Mr. Sawacha,

Your letter of 7th February has found its way to me as Head of Department. By chance I am a civil engineer and have to report that we are unable to give you any help at all. The few colleagues I have in civil engineering have not got any research work in the fields of Safety Attitudes and Safety Performance.

Yours sincerely,

C.P. Wroth

QUESTIONNAIRE SAMPLES

APPENDIX E

OPERATIVE QUESTIONNAIRE-(FINAL SURVEY)

****

SECTION ONE: HISTORICAL FACTORS.(1)

****

NOTE:Please tick only one box [✓],for each question in this section.

1.Who do you work for(or What type of Company or firm,do you work for)?

(a)Main contractor(Private Company) [ ],(b)Sub-Contractor(Private CO.)[ ],

(c)Council or Local Authority,or Government/Govt. Agency [ ],

(d)Self-Employed [ ], (e) Other type of Company,Please state:............

2.Are you working for a Managing Contractor on this job? (a)Yes [ ] (b)No [ ]

3.What is your present Job?
(a)General Labourer[ ], (b)Carpenters and Joiners[ ],(c)Bricklayer[ ],

(d)Mason[ ], (e)Roof slater and tiler[ ],(f)Floor,wall and ceiling tiler[ ],

(g)Plasterer[ ], (h)Painter and Decorator[ ],(i)Plumber and gas Fitter[ ],

(j)Heating and ventilating engineering worker[ ],(k)Glazier[ ],(l)Paviour[ ],

(m)Steel erector sheeter[ ],(n)Scaffolder[ ],(o)Electrician[ ],

(p)Mechanical equipment/Plant Operators[ ],(q)Other *Building and civil-Engin-eering* occupations,please state.....................................

4.IF you are a tradesperson,or you have a craft,how did you learn this trade or craft?

(a)Through an apprenticeship scheme,after leaving school[ ],

(b)By attending a craft course at a technical college,or school[ ],

(c)By working during the day,and going to college in the evening[ ],

(d)By apprenticeship only,with no schooling at the time [ ],

(e)Others,please state..

5.Do you belong to a Trade Union?(a)YES [ ], (b)NO [ ];IF NO,GO TO QUESTION 7.

6.If yes,which Trade Union do you belong?

(a)UCAAT [ ], (b)T & GWU [ ], (c)Other unions,please state....................

7.YOUR AGE:Are you:-(a)Under 21 years[ ],(b)21 to 25years[ ],(c)26 to 30years[ ]
(d)31 to 35years[ ],(e)36 to 40years[ ],(f)41 to 45years[ ],(g)46 to 50years[ ]
(h)51 to 55years[ ],(i)56 to 60years[ ],(j)61years and over[ ].

8.How long have you worked with this Company?

(a)Less than 1year[ ],(b)1 to 5years[ ],(c)6 to 10years[ ],(d)11 to15years[ ],

(e)16 to 20years[ ],(f)21 to 25years[ ],(g)26 to30years[ ],(h)31 to 35years[ ],

(i)36 to 40years[ ],(j)41 years,and over [ ].

9.How long have you worked in the Building Industry?
(a)Less than 1year[ ],(b)1 to 5years[ ],(c),6 to 10years[ ],(d)11 to15years[ ],
(e)16 to20years[ ],(f)21 to 25years[ ],(g)26 to 30years[ ],(h)31 to 35years[ ],
(i)36 to 40years[ ],(j)41 years,and over[ ].

PLEASE TURN OVER

SECTION TWO: ECONOMIC FACTORS.(2)
****

NOTE:PLEASE TICK ONLY ONE BOX[✓],FOR EACH QUESTION IN THIS SECTION. ONLY TICK THE ANSWER WHICH BEST EXPRESSES YOUR OPINION ,OR FEELINGS TO THE STATEMENTS MADE BELOW.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	COMMENTS
1.Shop Stewards should negotiate danger money for high-risk jobs with management.						
2.Banksmen are not presently given safety training to help them work safely on site.						
3.Paying bonus to workers lead to reduced concern for safety on site.						
4.A job with bonus lead supervisors to turn a blind-eye to workers taking unsafe chances.						
5.Paying workers safety bonus would reduce taking unsafe chances.						
6.Workers will always take risks as part of their jobs on site.						
7.Productivity and working safely on site must go together.						
8.I believe my company cares very much about my personal safety than profits.						

9.Does your Company operate a Bonus scheme?(a) Yes[ ],(b) No[ ],(c)Dont Know[ ]

10.Does your company pay Danger Money for jobs with high risks?

(a) Yes [ ], (b) No [ ], (c) Dont Know[ ]

SECTION THREE: PSYCHOLOGICAL FACTORS.(3)
****

NOTE: PLEASE TICK ONLY ONE BOX[✓], FOR EACH QUESTION IN THIS SECTION.

STATEMENT/OPINIONS	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	COMMENTS.
1. My own safety on site is very important.						
2. My workmates safety on site is not very important to me.						
3. The Health and Safety at work, Act, 1974. has made me to think more about safety on site.						
4. Safety training influences workers to work more safely.						
5. Building work is tough and dangerous as such, you need to be ready to take some risks if you are to work in it						
6. More experienced and skillful workers have less accidents.						
7. If my supervisor is careful about safety on site, that makes me careful too.						
8. If my workmates care less about safety on site, that makes me careless too.						

9. Do you like working in the Building Industry? (a)YES [ ], (b)NO [ ]

* If your answer to question 9, is NO, Then go to question 11 below.

10. If your answer to question 9is YES, Do your like working in Building because.........., PLEASE TICK ONE BOX[ ] ONLY BELOW:
(a) It is easy to get work in it [ ],
(b) It pays good money [ ],
(c) Most of the people I know work in building [ ],
(d) My family have always worked in building [ ],
(e) I like working in the open air [ ],
(f) other reason:........Please state.......................................

11. Do you know of the following Regulations concerning safety in Building?

	YES	NO
(a) The Health and Safety at work etc, Act, 1974?		
(b) The working Rule Agreement..................		
(c) The Construction(Health & Welfare)Reg., 1966..		
(d) The Construction(Working Places)..Reg., 1966..		
(e) The Construction(Lifting Operations)Reg., 1961		
(f) The Construction(General Provisions)Reg., 1961		

*IF NO, Please move on to SECTION FOUR(4) BELOW.

PLEASE TURN OVER

12.If YES,how did you find out about them?
Were you :
(a)Informed by your company ,manager,or supervisor? [ ].
(b)Informed by your Trade Union, or Union Representative[ ],
(c)Told of it by your workmates [ ],
(d)You read about it [ ],
(e)other source,please state...

SECTION FOUR:PROCEDURAL FACTORS.(4)

NOTE:PLEASE TICK ONLY ONE BOX [✓],FOR EACH QUESTION IN THIS SECTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	COMMENT
1.My company ought to supply me with safety boots,helmet and all safety equipments on site						
2.Workers who refuse to wear safety protective equipments on site should be punished somehow.						
3.Wearing safety protective clothings and equipments on site can prevent serious accidents on site.						
4.Workers should be trained on how and when to wear their safety equipments on site.						
5.Every Company should give their workers some kind of safety booklet which tells them how to work safely on site.						
6.Every worker on joining a new company should be given a short talk on safety and a safety booklet on the first day at work.						
7.I believe receiving safety instructions on the first day of joining a new company will help workers safety awareness.						

SECTION FIVE:TECHNICAL FACTORS.(5)

****

NOTE:PLEASE TICK ONLY ONE BOX[✓],FOR EACHQUESTION IN THIS SECTION.

STATEMENT/OPINION	STRONGLY-AGREE	AGREE	DONT-KNOW	DISAGREE	STRONGLY-DISAGREE	COMMENTS
1.Asbestos is harmful to your health and safety.						
2.If I see asbestos on site,I will know it at once.						
3.It is my own fault if I handle asbestos without protection.						
4.My Company does not have to tell me if there is asbestos on my site of work.						
5.To use mechanical plant or equipment on site without proper training, can kill someone.						
6.To clamber about on scaffoldings instead of using properly tied ladders on site can cause serious accidents to you.						
7.It is not necessary to have proper scaffolding inspections on site before use.						
8.Any person with some commonsense and some building experience can put up scaffolding for workers on site.						
9.You do not need any training to become a steel-erector.						
10.Driving a dumper on site is easy; anybody with some commonsense can drive one too.						
11.workers should refuse to operate mechanical plants on site if they have not received safety or operating instructions on them.						

PLEASE TURN OVER →

SECTION SIX:ORGANISATION FACTORS.(6)
****

NOTE:PLEASE TICK ANY ONE BOX[✓] OF YOUR CHOICE IN THIS SECTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	COMMENTS
1.More accidents happen when workers and managements relationships are bad on site.						
2.Trade Unions involvement with safety,can reduce accidents on site						
3.Sub-Contractors donot care about safety on site as main contractors do.						
4.Having safety Representatives on every site, can lead to less accidents on site						
5.Mangement alone cannot prevent accidents,workers must co-operate by working safely.						
6.Safety Committees can improve Health and Safety on sites.						
7.I believe that my company is doing enough about my safe--ty on site.						
8.My managers and supervisors do not talk to me enough about health and safety on site.						
9.Properly printed safety posters and warnings displ--ayed in site huts,and around the site,make me think about safety on site.						

NOTE: PLEASE ALSO ANSWER QUESTIONS 10 to 12 below.

10. Do you have a safety Representative on the site where you are working now?
(a) YES [ ], (b) NO [ ], (c) DONT KNOW [ ]

11. Do you have a safety Committee in your present Company where you work?
(a) YES [ ], (b) NO [ ], (c) DONT KNOW [ ]

12. What things are your company not doing in regard to Health and Safety?
SEE the list below, and tick those things your company is not doing at present.

- i. Have daily safety inspections on my site [ ],
- ii. Give safety training to all new workers.. [ ]
- iii. Give workers safety bonus .... [ ]
- iv. Give all workers safety boots and helmet.. [ ]
- v. Give supervisors and workers joint training [ ]
- vi. All access to positions of work clearly marked [ ]
- vii. Workers are told how and when to use safety equipments. [ ]
- viii. All scaffoldings are well inspected on site, before workers are allowed to use them. [ ],
- ix. All trenches are well timbered on site. [ ],
- x. Workers are sent home if found drunk on site [ ],
- xi. Openings in floors are well protected with tapes or rails [ ]
- xii. Leading-edges are regularly inspected on site [ ]
- xiii. Anything Else, Please state.......................................

SECTION SEVEN: ENVIRONMENTAL / EXTERNAL FACTORS. (7)

****

NOTE: PLEASE TICK ONLY ONE BOX [✓] TO EACH QUESTION BELOW AS BEFORE.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	COMMENTS
1. Clean and tidy sites prevent some accidents happening.	11					
1 2. Workers who know their jobs, and think about what they are doing during work, have less accidents on site.						
3. Untidy building sites do not cause accidents.	11					
1 4. Workers co-operat- -ing with each other while working together, have less accidents						
5. My company do not gives us instructions about working with toxic materials, fumes, and most harmful substances on site.						
6. Workers are more likely to follow the good or bad examples of their supervisors and managers, than their workmates on site.						
7. Properly planned and organised jobs can reduce the causes of some accidents						
8. Most accidents on site can be avoided by workers being a little more careful and observant on site						

PLEASE TURN OVER

SECTION EIGHT:SAFETY PERFORMANCE FACTORS.(8)
****

NOTE:PLEASE TICK ONLY ONE BOX[ ]IN ANSWER TO EACH QUESTION BELOW.

1.How often do you see safety inspections carried out on your sites?

(a) Every day [ ], (b) Once a week [ ],

(c) Once in two weeks [ ], (d) Once a month [ ],

(d) Once in two months [ ], (f) Once in three months[ ],

(g) Never [ ], (h) Other, please state................................

2.Have you received any training in Health and Safety at all?

(a) YES [ ], (b)NO [ ];*IF NO,Please GO onto Question 6 below.

3.If YES,continue and tick what type of safety training you have received:

(a) First-Aid course [ ], (b) Fire - Fighing and drill [ ],

(c) Scaffolding inspection [ ], (d) Working on roofs [ ],

(e) Timbering trenches [ ], (f) General site safety [ ],

(g) Any other type you have had,please state...........................

4.Would you know if safety inspections are being carried out on site?
(a) Yes...[ ] (b) No [ ]

5.How would you describe the safety training you received?

(a) Very Useful [ ], (b) Useful abit[ ],

(c) Not very useful [ ], (d) *totally useless [ ].*

6.How long ago did you receive you safety training ?

(a) Under 1year,or 12 months ago [ ], (b)1 to 2 years ago [ ],

(c) 3 to 5 years ago [ ], (d) 6 to 10 years ago [ ],

(e) Over 10 years ago [ ].
7.Does your company tell you of accidents on their sites?(a)Yes[ ](b)No[ ]
8.Have you ever had any accident/ or accidents on site,in the last 5 years?

(a)YES [ ],(b)NO [ ]**IF NO,PLEASE STOP HERE,AND DONT GO ANY FURTHER:THANK YOU
****IF YES,PLEASE CONTINUE WITH QUESTION 9 BELOW. CHEERS.

9.What type or types of accidents did you have,or suffer?
PLEASE,Tick as many as you know you had in the last 5 years
--while you were working in the Building Industry.

(a) Falls from scaffoldings and working platforms.......................[ ]
(b) Falls from or through roofs..[ ]
(c) Nails through your feet or working shoes(not wearing safety boots)[ ]
(d) Falls from heights during erection of steelwork,formwork,or
other structural framework or platforms.........................[ ]
(e) Falls due to collapse of scaffoldings,other frame-works,of platform[ ]

(f) Injury to eyes due to dust or debri,fumes or toxic substances......[ ]

(g) Falls of materials from heights above your head level.............[ ]

(h) Falls from untied ladders,falls from ladders due to other reasons..[ ]

(i) Collapse of a trench or deep holes, while you were carrying out work[ ]

(j) Collapse or over-turning of crane,or other lifting equipment on site[ ]

(k) Accidents caused by transport vehicles,dumpers,lorries,trucks,etc...[ ]

(l) Fire or Explosions of any kinds on site..............................[ ]
(m) Accidents caused due to electric shocks,or from electrical appliances[ ]

(n) Any other type,please state..

10.Did you take time-off because of the accident/s? (a)YES[ ],(b)NO[ ]

11. IF NO,did you receive any First-Aid on site,then went back to work?[ ]
(a) YES [ ] (b) NO [ ]

12.IF you took time-off because of your accident,how much timeoff ?
(a)Less than 3 days....[ ]
(b)3-days to 1-week.....[ ]
(c)More than 1-week.....[ ]
(d)2-weeks to 1-month...[ ]
(e)Over 1-month.........[ ]

END.

THANK YOU SO MUCH FOR YOUR PATIENCE AND GREAT HELP.

EDWIN.

SITE MANAGEMENT QUESTIONNAIRE-FINAL SURVEY.

*NOTE: IN STRICT CONFIDENCE.

INSTRUCTIONS: This questionnaire is arranged under Eight SECTIONS. To complete each section, please follow the notes at the start of the section, as you proceed from section to section, until you reach the end of section (8). All you are required to do, is to read each question, statement, or opinion, and put a tick , in the box which best describes your feelings, or thinking towards it. There are no right or wrong answers, so feel free to indicate your personal feelings or views to the questions or statements made. Please try to exercise patience, and complete all the sections of the questionnaire.
COMPLETE CONFIDENTIALITY IS GUARANTEED. THANK YOU.

SECTION ONE: HISTORICAL FACTORS.

NOTE: Please tick only one box[ ] for each question in this section.

1. What type of firm do you work for?

(a) Main contractor(private company) [ ]
(b) Sub-contractor (private company) [ ]
(c) Government/Local Authority(Public) [ ]
(d) Self-Employed-------------------- [ ]
(e) Management Contractor------------ [ ]
(f) Other type of firm not listed, please state....................

2. If your firm is a sub-contractor, Are you working in this project for a:-

(a) Main Contractor....................[ ]
(b) Managing Contractor................[ ]
(c) Project Manager....................[ ]
(d) Other, please state..

3. What is the nature of your firm's work, or trade?

(a) General Builders [ ]
(b) Building and Civil Engineering contractors [ ]
(c) Civil Engineers [ ]
(d) Plumbers.............................. [ ]
(e) Carpenters/Joiners [ ]
(f) Painters and Decorators................ [ ]
(g) Roofers........... [ ]
(h) Plasterers............................ [ ]
(i) Glaziers.......... [ ]
(j) Demolition contractors................ [ ]
(k) Scaffolding....... [ ]
(l) Reinforced concrete specialists........... [ ]
(m) Electrical Engineers [ ]
(n) Heating and Ventilating Engineers......... [ ]
(o) Asphalt/Tar-Sprayers [ ]
(p) Plant Hirers.............................. [ ]
(q) Flooring Contractors [ ]
(r) Construction Engineers................... [ ]
(s) InsulatingSpecialist [ ]
(t) Suspended Ceiling Specialists............ [ ]
(u) Floor and Wall Tiling Specialists............................ [ ]
(v) Groundwork specialists....................................... [ ]
(w) Others, please state..

4. What is your job Or position?

(a) Site Manager/Site Agent.....[ ]
(b) General Foreman.............[ ]
(c) Trade Foreman/ Chargehand...[ ]
(d) Supervisor..................[ ]
(e) Project Manager.............[ ]
(f) Section Manager.............[ ]
(g) Others, please state...................................

PLEASE TURNOVER.>

5.What trade or craft did you come from(or Your trade background)?

(a) Bricklayer.............[ ]; (b)Carpenter&Joiner.....................[ ];
(c)Painter/Decorator.......[ ]; (d)Plasterer...........................[ ];
(e) Roofer.................[ ]; (f)Scaffolder..........................[ ];
(g)Plumber.................[ ]; (h)Electrician.........................[ ];
(i)Plant Operator.or.fitter[ ]; (j)General Labourer....................[ ];
(k) Universtty Graduate....[ ]; (l)Technical College Educated..........[ ];
(m) Others,please state..

6.What is the size of your Organisation,or Firm?
(OR How many persons are employed in your firm?)

(a) One person.............[ ]; (b) 2-to-3 persons.........[.];........
(c) 4-to-7 persons.........[ ]; (d) 8-to-13 persons........[ ];
(e) 14-to-24 persons.......[ ]; (f) 25-to-34 persons.......[ ];
(g) 35-to-59 persons.......[ ]; (h) 60-to-79 persons.......[ ];
(i) 80-to-114 persons......[ ]; (j) 115-to-299 persons.....[ ];
(k) 300-to-599 persons.....[ ]; (l) 600-to-1,199 persons...[ ];
(m)1,200 and over..........[ ].

7.Do you belong to any Trade Union Organisation/Organisations?

(a) Yes [ ]; (b) No [ ]

8.If yes,which Trade Union Organisation do you belong,Please state..........

....

9.Are you married? (a) Yes...[ ]; (b) No...[ ]

10.I am (a) Male..[ ], (b) Female....[ ]

11.YOUR AGE: ARE YOU:-

(a)Under 21 years......[ ] (b) 21-to-25 years.....[ ]
(c)26-to-30 years......[ ], (d) 31-to-35 years....[ ];
(e)36-to-40 years......[ ]; (f) 41-to-45 years....[ ];
(g)46-to-50 years......[ ]; (h) 51 years,and over.[ ].

12.How long have you worked with this Company?

(a)Under 1year..........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10years.........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ]; (f)21-to-25years.....[ ];
(g)26-to-30years........[ ]; (h) 31 years,and over.[ ].

13.How long have you worked in the Building Industry?

(a)Under 1 year.........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10 years........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ]; (f) 21-to-25years.....[ ];
(g)26-to-30years........[ ]; (h) 31years,and over..[ ].

14.Are you a member of any professional Institution?

(a) Yes................[ ]; (b) No.................[ ].

15. If Yes,please state which one,or ones...................

....

SECTION TWO: ECONOMIC FACTORS(2)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW,
---- BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. Bonus systems interfer with safety organisation on a site.						
2. Accidents involving injuries and property damages, amount to financial and productivity losses.						
3. Bonus systems lead to supervisors turning a blind-eye to safety hazards.						
4. Spending on safety training in the building industry is inadequate for improving safety performance						
5. The need to achieve Commercial advantages by management influences safety organisation on site.						
6. Safety should be a separately priced item in all tenders or contracts.						
7. The Client should ensure that all contractors price safety as a separate item in their tender documents.						
8. Compliance with safety provisions in contract documents, will improve safety on site.						
9. Site safety is a more important factor in building than productivity.						
10. Awarding safety bonus to workers would lead to improved safety performance in the building industry.						

PLEASE TURNOVER >

SECTION THREE: PSYCHOLOGICAL FACTORS(3).

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW, BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION. THE SQUARE THAT MOST EXPRESSES YOUR TRUE FEELINGS/REACTION TOWARDS THE STATEMENT MADE, IS THE ONE YOU SHOULD TICK.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. Creating individual safety awareness can lead to less accidents on sites.						
2. Worker's irresponsible behaviour on site can undermine safe-working.						
3. Building work is tough and dangerous and as such, anyone who works in building must be strong, tough, and be prepared to take risks.						
4. Client's pressure to achieve programme lead to safety being undermined.						
5. Safety is mostly a matter of commonsense.						
6. Individual carelessness is a major cause of construction accidents.						
7. The sense of urgency in jobs forces site - managers to pay less attention to site safety.						
8. Co-operation between members of project teams is important for reducing accidents on site.						
9. Site Management's attitude to safety on site is a major factor of influence to workers safety behaviour.						
10. Poor co-operation between sub-contractors on site undermines safety.						

SECTION FOUR:PROCEDURAL FACTORS(4).

NOTE:PLEASE TICK ONLY ONE SGUARE BOX [],FOR EACH QUESTION.

STATEMENT/OPINION-	-STRONGLY-AGREE	-AGREE-	-DONT-KNOW	-DISAGREE-	-STRONGLY-DISAGREE	-ANY COMMENTS
1.Reporting Near--Accident misses, can lead to the prevention of future accidents.						
2.Investigating near-accidents on site by site managers is a fruitless exercise.						
3.It is not really necessary for safety procedures in a job to be considered at tender stages.						
4.Firms ought to provide workers with all their safety equipments, and safety protective clothing,including boots.						
5.Anyone who repeatedly fail to wear their safety protective clothings and equipments, ought to be sacked.						
6.Site Managers have responsibility for safe-working pro--cedures,and systems on their sites.						
7.Considering safe--procedures, and systems of work at tender,leads to improved safety performance.						
8.All workers in the building industry,should be provided with safety booklets and training.						
9.Providing all workers with proper safety training & safety booklets would improve safety performance in the building industry.						

PLEASE TURNOVER>

SECTION FIVE: TECHNICAL FACTORS(5)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS/OPINIONS BELOW,
----- BY TICKING ONLY ONE SQUARE/BOX TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENT
1. Workers should refuse to operate items of plant, or equipments for which they have received no operating and safety training.						
2. Most workers in the building industry lack knowledge of safety hazards on site.						
3. Workers ability to spot safety hazards on site would lead to less accidents.						
4. Most workers with commonsense could drive a dumper, fork-lift, or other machines on site after a little site demonstration.						
5. A steady flow of safety information from management to workers, is very lacking in the building industry.						
6. Training of Site managers in health, and safety in the UK, is inadequate for carrying out effective safety inspections on site.						
7. The wearing of safety protective clothings and equipments reduces workers efficiency.						
8. All Specialist -sub-contractors, should supply method statements and safety policies with their tenders.						
9. Present methods of tendering, discriminate strongly against safety conscious contractors.						
10. Pressure and Tiredness lead to accidents on site.						

SECTION SIX; ORGANISATION AND MANAGEMENT FACTORS(6).

NOTE: PLEASE INDICATE YOUR ANSWERS TO THE STATEMENTS/OPINIONS BELOW,
-----BY TICKING THE BOX, WHICH BEST DESCRIBES YOUR FEELINGS TO THEM.
ONLY ONE BOX TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. More accidents occur, when worker-management relations are bad.						
2. Trade Union involvement with safety, can reduce accidents.						
3. Having Safety Representatives on sites, will not improve safety standards.						
4. Site Managers, and Safety Advisers or Officers have responsibility for safety on sites.						
5. Management alone cannot prevent accidents on site, workers must play their part by working safely.						
6. Managers and supervisors do not talk to their workers enough, about Health and Safety on site.						
7. Having safety Committees in a company, improves safety standards in the organisation.						
8. More Factory Inspectors in the Building Industry would improve health and safety performance.						
9. Management safety attitudes, determines worker's safety behaviour on site.						
10. Poor co-ordination of sub-contractor's work on site by main contractors and managing contractors lead to poor safety performance on site.						

PLEASE TURNOVER >

SECTION SEVEN: ENVIRONMENTAL FACTORS(7)

NOTE: Please indicate your answers to the statements/Opinions made below,
----- by ticking one box only to each question.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1.A single contractor responsibilitu for all scaffolding on site,is important to the improvement of safety standards.						
2.Untidy building sites can cause accidents on site.						
3.Provision of good quality welfare, and first aid facilities on site,improves safety standards.						
4.Providing workers with thermal/warm clothings in winter, can improve safe working on site.						
5.Good job planning, and site organisation, causes low accidents.						
6.An inadequate supply of the right type and quality tools, plants,and equipments, leads to accidents and damages on site.						
7.The attitudes of older workers to safety and health, is a major source of influence to new recruits in the building industry.						
8.Thermal discomfort of workers in the winter,is not a major safety problem.						
9.Inadequate control and supervision of workers on site,is a major factor in accident occurence.						
10.Workers can reduce the causes of some accidents on site simply by being a little more thoughtful of what they do						

SECTION EIGHT: SAFETY PERFORMANCE FACTORS(8).

~~NOTE: YOU HAVE COME TO THE FINAL SECTION OF~~ THIS QUESTIONNAIRE.
PLEASE CONTINUE.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENT
1. Regular assessment of safety on sites on a competitive basis increases safety awareness.						
2. The Health and safety Inspectorate have inadequate resources to enforce safety in the construction industry.						
3. Regular hazard analysis and updating by management would lead to an improved safety performance on site.						
4. Efficient hazard analysis and updating should become a key management function to improve safety performance on site.						
5. Displaying all accident information on sites would prevent risk-taking by workers.						
6. Alcohol and drugs are not major problems for safety on site.						
7. All companies in the building industry should have alcohol and drug policies						
8. Lack of safety consultation between Clients, Engineers, Designers, Managing Contractors and Sub-contractors undermines safety performance on contracts.						
9. Safety provisions in tender documents are too vague for promoting better safety on site.						
10. Most accidents occur on multi-occupied sites due to inadequate control of sub-contractors.						

MANY THANKS FOR YOUR PATIENCE, AND CO-OPERATION.
EDWIN.

CONTRACT MANAGEMENT QUESTIONNAIRE - FINAL SURVEY.
****

*NOTE:IN STRICT CONFIDENCE.

INSTRUCTIONS:This questionnaire is arranged under Eight SECTIONS.
------------To complete each section,please follow the notes at the start of the section,as you proceed from section to section,until you reach the end of section (8).All you are required to do is to read each question,statement,or opinion,and put a tick in the box which best describes your feeling,or thinking towards it. There are no right or wrong answers,so feel free to indicate your personal feelings or views to the questions or statements made. Please try to exercise patience, and complete all the sections of the questionnaire.
COMPLETE CONFIDENTIALITY IS GUARANTEED. THANK YOU.

SECTION ONE: HISTORICAL FACTORS.

NOTE:Please tick only one box[ ] for each question in this section.

1.What type of firm do you work for?
(a) Main contractor(private company) [ ]
(b) Sub-contractor (private company) [ ]
(c)Government/Local Authority(Public) [ ]
(d) Self-Employed-------------------- [ ]
(e) Management Contractor------------ [ ]
(f) Other type of firm not listed,please state....................

2. If your firm is a sub-contractor,are you working in this project for a:-
(a) Main Contractor....................[ ]
(b) Managing Contractor................[ ]
(c) Project Manager....................[ ]
(d) Other,please state...

3.What is the nature of your firm's work,or trade?
(a)General Builders [ ] (b)Building and Civil Engineering contractors[ ]
(c)Civil Engineers [ ] (d)Plumbers.................................[ ]
(e)Carpenters/Joiners[ ] (f)Painters and Decorators..................[ ]
(g)Roofers...........[ ] (h)Plasterers................................[ ]
(i)Glaziers..........[ ] (j)Demolition contractors....................[ ]
(k)Scaffolding.......[ ] (l)Reinforced concrete specialists...........[ ]
(m)Electrical Engineers[ ] (n)Heating and Ventilating Engineers........[ ]
(o)Asphalt/Tar-Sprayers[ ] (p)Plant Hirers............................[ ]
(q)Flooring Contractors[ ] (r)Construction Engineers..................[ ]
(s)InsulatingSpecialist[ ] (t)Suspended Ceiling Specialists...........[ ]
(u)GroundWorkers.......[ ] (v)Steel Erectors..........................[ ]
(w)Floor and Wall tiling Specialists..................................[ ]
(x)Others,please state...

4.What is your job Or position?

(a) Managing Director......[ ]
(b) Contracts Director.....[ ]
(c) Contracts Manager......[ ]
(d) Project Manager......[ ]
(e) Others,please state...

5. Are you (a)Full-Time on site[ ] (b)Part-Time on site/Visiting[ ]

6. If visiting,how frequently do you visit your sites?

(a)1-2times per week[ ] (b)3-5times per week[ ] (c)Fortnightly[ ]
(d)Others,please state..

PLEASE TURNOVER >

7.What trade or craft did you come from(or your trade background,if any)?

(a) Bricklayer.............[ ]; (b)Carpenter&Joiner..................[ ];
(c)Painter/Decorator.......[ ]; (d)Plasterer.........................[ ];
(e) Roofer.................[ ]; (f)Scaffolder........................[ ];
(g)Plumber.................[ ]; (h)Electrician.......................[ ];
(i)Plant Operator.or.fitter[ ]; (j)General Labourer..................[ ];
(k) University Graduate....[ ]; (l)Technical College Educated........[ ];
(m) Others,please state...

8.What is the size of your Organisation or Firm?
(OR How many persons are employed in your firm?)

(a) 1-to-10 persons........[ ] (b) 11-to-50 persons.....[ ]

(c) 51-to-200 persons......[ ] (d) 201-to-500 persons...[ ]

(e) 501-to-1000 persons....[ ] (f) 1001 and above.......[ ]

9.Do you belong to any Trades Union Organisation/s?

(a) Yes [ ]; (b) No [ ]

10.Are you married? (a) Yes...[ ] (b) No...[ ]

11.I AM:-..........(a) Male..[ ] (b) Female[ ]

12.YOUR AGE: YOU ARE:-

(a)Under 21 years......[ ] (b) 21-to-25 years.....[ ]
(c)26-to-30 years......[ ], (d) 31-to-35 years....[ ];
(e)36-to-40 years......[ ]; (f) 41-to-45 years....[ ];
(g)46-to-50 years......[ ]; (h) 51 years,and over.[ ].

13.How long have you worked with this Company?

(a)Under 1year..........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10years.........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ] (f) 21-to-25years.....[ ]
(g)26-to-30years........[ ]; (h) 31 years,and over.[ ].

14.How long have you worked in the Building Industry?

(a)Under 1 year.........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10 years........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ]; (f) 21-to-25years.....[ ];
(g)26-to-30years........[ ]; (h) 31years,and over..[ ].

15.Are you a Member of any professional Institution?

(a) Yes................[ ]; (b) No.................[ ].

16. If yes,please state which one/s:..................................

17.Have you a Technical Qualification? (a) Yes..[ ] (b) No..[ ]

18.If yes,what qualification/s? (a) City & Guilds...........[ ]
(b)OND/ONC...[ ] (c)HND/HNC...[ ] (d)BTEC...............[ ]
(e)Others,please state......................................

19.Was safety a taught subject on your Course of Studies?
(a)Yes.......[ ] (b)No........[ ]

20.When did you first receive any formal instructions in safety at work?
Please state...

SECTION TWO:ECONOMIC FACTORS(2)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW,
---- BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION.

STATEMENT/OPINION-	-STRONGLY- AGREE	-AGREE-	-DONT- KNOW	-DISAGREE-	-STRONGLY- DISAGREE	-ANY COMMENTS
1.Bonus systems interfer with safety organisation on a site.						
2.Accidents involving injuries and property damages, amount to financial and productivity losses.						
3.Bonus systems lead to supervisors turning a blind-eye to safety hazards.						
4.Spending on safety training in the building industry is inadequate for improving safety performance						
5.The need to achieve Commercial advantages by management influences safety organisation on site.						
6.Safety should be a separately priced item in all tenders or contracts.						
7.The Client should ensure that all contractors price safety as a separate item in their tender documents.						
8.Compliance with safety provisions in contract documents,will improve safety on site.						
9.Site safety is a more important factor in building than productivity.						
10.Awarding safety bonus to workers would lead to improved safety performance in the building industry.						

PLEASE TURNOVER >

SECTION THREE: PSYCHOLOGICAL FACTORS(3).

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW, BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION. THE SQUARE THAT MOST EXPRESSES YOUR TRUE FEELINGS/REACTION TOWARDS THE STATEMENT MADE, IS THE ONE YOU SHOULD TICK.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. Creating individual safety awareness can lead to less accidents on sites.						
2. Worker's irresponsible behaviour on site can undermine safe-working.						
3. Building work is tough and dangerous and as such, anyone who works in building must be strong, tough, and be prepared to take risks.						
4. Client's pressure to achieve programme lead to safety being undermined.						
5. Safety is mostly a matter of commonsense.						
6. Individual carelessness is a major cause of construction accidents.						
7. The sense of urgency in jobs forces site - managers to pay less attention to site safety.						
8. Co-operation between members of project teams is important for reducing accidents on site.						
9. Site Management's attitude to safety on site is a major factor of influence to workers safety behaviour.						
10. Poor co-operation between sub-contractors on site undermines safety.						

SECTION FOUR:PROCEDURAL FACTORS(4).

NOTE;PLEASE TICK ONLY ONE SQUARE BOX [],FOR EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1.Investigating Near-Accidents can lead to the prevention of future accidents.						
2.Pressure to get on with the job prevent managers from investigating near-accidents on site.						
3.It is not really possible for safety procedures in a job to be considered at tender stages.						
4.Firms ought to provide workers with all their safety equipment and weather-proof clothing,including boots.						
5.Distributing and updating approved subcontractor's method statements on site would improve safety performance.						
6.Failure to allow adequate times in programmes for safety provisions lead to poor safety performance.						
7.Considering safe-procedures and systems of work at tender leads to improved safety performance.						
8.All workers in the building industry should be provided with safety booklets by their companies.						
9.Standard safety conditions and method statements for sub-contractors should be enforced on site.						

PLEASE TURNOVER >

SECTION FIVE: TECHNICAL FACTORS(5)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS/OPINIONS BELOW,
----- BY TICKING ONLY ONE SQUARE/BOX TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENT
1. Workers should refuse to operate items of plant or equipments for which they have received no operating and safety training.						
2. Its management's obligation to demand safety method statements for all hazardous operations.						
3. Providing method statements for safe working procedures should be a condition of contract						
4. Wearing protective clothings and equipments on site ought to be a condition of employment						
5. A steady flow of safety information from management to workers is very lacking in the construction industry.						
6. Training of contract managers in health and safety is inadequate for carrying out efficient safety administration on site.						
7. The wearing of safety protective clothing and equipment reduces workers efficiency.						
8. All Specialist sub-contractors, should supply method statement, and safety policies with their tenders.						
9. Present methods of tendering discriminate strongly against safety conscious contractors.						
10. Fatigue due to long hours worked on site could lead to accidents.						

SECTION SIX; ORGANISATION AND MANAGEMENT FACTORS(6).

NOTE:PLEASE INDICATE YOUR ANSWERS TO THE STATEMENTS/OPINIONS BELOW,
-----BY TICKING THE BOX,WHICH BEST DESCRIBES YOUR REACTION TO THEM.
PLEASE TICK ONE BOX ONLY FOR EACH QUESTION.

STATEMENT/OPINION	STRONGLY-AGREE	AGREE	DONT-KNOW	DISAGREE	STRONGLY-DISAGREE	ANY COMMENTS
1.More accidents occur when worker-management relations are bad.						
2.Trade Union involvement with safety,can reduce accidents.						
3.Having Safety Representatives on sites,will not improve safety standards.						
4.Site Management and main board directors have responsibility for safety on sites.						
5.Management alone cannot prevent accidents on site, workers must play their part by working safely.						
6.Managers and supervisors do not talk to their workers enough, about Health and Safety on site.						
7.Having safety Committees in a company,improves safety standards in the organisation.						
8.More Factory Inspectors in the Building Industry cannot improve health and safety performance.						
9.Management safety attitudes determine worker's safety behaviour on site.						
10.Poor co-ordination of sub-contractor's work on site by main-contractors and managing contractors can influence safety performance.						

PLEASE TURNOVER >

SECTION SEVEN: ENVIRONMENTAL FACTORS(7)

NOTE: Please indicate your answers to the statements/Opinions made below,
----- by ticking one box only to each question.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. A single contractor responsibility for all scaffolding on site is important to the improvement of safety standards.						
2. Untidy building sites can lead to accidents occuring						
3. Provision of good quality welfare and first-aid facilities on site improves safety standards.						
4. Providing workers with thermal/warm clothings in winter can lead to accident reduction on site.						
5. Good job planning, and site organisation, improves safety performance.						
6. An inadequate supply of the right type and quality tools, plants and equipment leads to accidents and damage on site.						
7. The attitude of older workers to safety and health is a major source of influence to new recruits in the building industry.						
8. Regular safety meetings with main and subcontractors is imperative for improving safety co-ordination on site.						
9. Inadequate control and supervision of workers on site is a major factor in accident occurence.						
10. Managers can reduce the causes of most accidents on site by being a little more thoughtful about safety provisions on site.						

SECTION EIGHT: SAFETY PERFORMANCE FACTORS(8).

NOTE: YOU HAVE COME TO THE FINAL SECTION OF THIS QUESTIONNAIRE. PLEASE TRY TO ANSWER THE REST,BY TICKING ONE BOX FOR EACH QUESTION AS BEFORE:CHEERS.

STATEMENT/OPINION	STRONGLY-AGREE	AGREE	DONT-KNOW	DISAGREE	STRONGLY-DISAGREE	ANY COMMENT
1.Safety assessment of sites on very competitive, and regular basis,encourages safety awareness.						
2.The Health and Safety Inspectorate have inadequate manpower and resources to enforce safety in the construction industry.						
3.Hazard identification or Hazard seeking,ought to be conducted regularly by site managers.						
4.Efficient hazard identification, is a key factor in encouraging effective safety performance.						
5.Displaying all accident information on sites, would not prevent workers taking risks.						
6.Alcohol and drugs are not major problems for safety in the construction industry.						
7.All companies in the building industry,should have an alcohol and drug policies.						
8.Lack of safety consultation in the industry, between contract management,and site management, undermines safety.						
9.Safety provisions in contracts are too vague for promoting better safety on site.						
10.Most accidents occur on multi-occupied sites due to inadequate control of sub-contractors.						

MANY THANKS FOR YOUR PATIENCE,AND CO-OPERATION.
EDWIN.

SAFETY ADVISER/OFFICER (ETC) QUESTIONNAIRE - FINAL SURVEY.

*NOTE:IN STRICT CONFIDENCE.

INSTRUCTIONS:This questionnaire is arranged under Eight SECTIONS. To complete each section,please follow the notes at the start of the section,as you proceed from section to section,until you reach the end of section (8).All you are required to do is to read each question,statement,or opinion,and put a tick in the box which best describes your feeling,or thinking towards it. There are no right or wrong answers,so feel free to indicate your personal feelings or views to the questions or statements made. Please try to exercise patience, and complete all the sections of the questionnaire.
COMPLETE CONFIDENTIALITY IS GUARANTEED. THANK YOU.

SECTION ONE: HISTORICAL FACTORS.

NOTE:Please tick only one box[ ] for each question in this section.

1.What type of firm do you work for?

(a) Main contractor(private company) [ ]
(b) Sub-contractor (private company) [ ]
(c)Government/Local Authority(Public) [ ]
(d) Self-Employed-------------------- [ ]
(e) Management Contractor------------ [ ]
(f) Other type of firm not listed,please state....................

2. If your firm is a sub-contractor,are you working in this project for a:-

(a) Main Contractor....................[ ]
(b) Managing Contractor................[ ]
(c) Project Manager....................[ ]
(d) Other,please state...

3.What is the nature of your firm's work,or trade?

(a)General Builders [ ]
(b)Building and Civil Engineering contractors[ ]
(c)Civil Engineers [ ]
(d)Plumbers.................................[ ]
(e)Carpenters/Joiners[ ]
(f)Painters and Decorators..................[ ]
(g)Roofers...........[ ]
(h)Plasterers...............................[ ]
(i)Glaziers..........[ ]
(j)Demolition contractors...................[ ]
(k)Scaffolding.......[ ]
(l)Reinforced concrete specialists...........[ ]

(m)Electrical Engineers[ ]
(n)Heating and Ventilating Engineers........[ ]
(o)Asphalt/Tar-Sprayers[ ]
(p)Plant Hirers.............................[ ]
(q)Flooring Contractors[ ]
(r)Construction Engineers...................[ ]
(s)InsulatingSpecialist[ ]
(t)Suspended Ceiling Specialists............[ ]
(u)Floor and Wall Tiling Specialists.........................[ ]
(V)Ground workers..[ ]
(w)Others,please state..

4.What is your job Or position?

(a) Chief Group Safety Adviser/Officer..[ ]
(b) Safety Adviser......................[ ]
(c) Safety Officer......................[ ]
(d) Safety Engineer.....................[ ]
(e) Others,please state...

PLEASE TURNOVER >

5.What trade or craft did you come from(or your trade background)?

(a) Bricklayer.............[ ]; (b)Carpenter&Joiner..................[ ];
(c)Painter/Decorator.......[ ]; (d)Plasterer.........................[ ];
(e) Roofer.................[ ]; (f)Scaffolder........................[ ];
(g)Plumber.................[ ]; (h)Electrician.......................[ ];
(i)Plant Operator.or.fitter[ ]; (j)General Labourer..................[ ];
(k) University Graduate....[ ]; (l)Technical College Educated........[ ];
(m) Others,please state..

6.What is the size of your Organisation,or Firm?
(OR How many persons are employed in your firm?)

(a) 1-to-10 persons........[ ] (b) 11-to-50 persons.....[ ]

(c) 51-to-200 persons......[ ] (d) 201-to-500 persons...[ ]

(e) 501-to-1000 persons....[ ] (f) 1001 and above.......[ ]

7.Do you belong to any Trade Union Organisation/Organisations?

(a) Yes [ ]; (b) No [ ]

8.If yes,which Trade Union Organisation do *you belong,Please state*..........

....

9.Are you married? (a) Yes...[ ]; (b) No...[ ]

10.I am (a) Male..[ ], (b) Female....[ ]

11.YOUR AGE: ARE YOU:-

(a)Under 21 years......[ ] (b) 21-to-25 years.....[ ]
(c)26-to-30 years......[ ], (d) 31-to-35 years....[ ];
(e)36-to-40 years......[ ]; (f) 41-to-45 years....[ ];
(g)46-to-50 years......[ ]; (h) 51 years,and over.[ ].

12.How long have you worked with this Company?

(a)Under 1year..........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10years.........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ] (f) 21-to-25years.....[ ],
(g)26-to-30years........[ ]; (h) 31 years,and over.[ ].

13.How long have you worked in the Building Industry?

(a)Under 1 year.........[ ]; (b) 1-to-5 years......[ ];
(c)6-to-10 years........[ ]; (d) 11-to-15years.....[ ];
(e)16-to-20years........[ ]; (f) 21-to-25years.....[ ];
(g)26-to-30years........[ ]; (h) 31years,and over..[ ].

14.Are you a member of any professional Institution?

(a) Yes................[ ]; (b) No.................[ ].

15. If Yes,please state which one,or ones...................

....

SECTION TWO:ECONOMIC FACTORS(2)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW, BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. Bonus systems interfer with safety organisation on a site.						
2. Accidents involving injuries and property damages, amount to financial and productivity losses.						
3. Bonus systems lead to supervisors turning a blind-eye to safety hazards.						
4. Spending on safety training in the building industry is inadequate for improving safety performance						
5. The need to achieve Commercial advantages by management influences safety organisation on site.						
6. A percentage of the job cost should be included in the tender sum for safety in every contract.						
7. The Client should do more to ensure that contractor's prices include a percentage of the job cost for safety in the tender sum.						
8. Contractor's compliance with safety provisions promotes better safety.						
9. Site safety should be a more important factor in building than productivity.						
10. Awarding safety bonus to workers would lead to improved safety performance in the building industry.						

PLEASE TURNOVER >

SECTION THREE: PSYCHOLOGICAL FACTORS(3).

NOTE:PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS BELOW,
---- BY TICKING ONE SQUARE/BOX ONLY TO EACH QUESTION.
THE SQUARE THAT EXPRESSES YOUR TRUE FEELINGS,OR OPINION
TOWARDS THE STATEMENT MADE,IS THE ONE YOU SHOULD TICK.

STATEMENT/OPINION	STRONGLY-AGREE	AGREE	DONT-KNOW	DISAGREE	STRONGLY-DISAGREE	ANY COMMENTS
1.Creating individual safety awareness can lead to less accidents on sites.						
2.Worker's irresponsible behaviour on site can undermine safe-working.						
3.Building work is tough and dangerous and as such, anyone who works in building must be strong,tough, and be prepared to take risks.						
4.Safety awareness can only be instilled into workers through regular safety training.						
5.Safety is mostly a matter of commonsense & training.						
6.Individual carelessness is a major cause of construction accidents.						
7.The sense of urgency in jobs forces site - managers to pay less attention to site safety.						
8.Co-operation between site-management and safety Advisers is important in reducing site accidents.						
9.Site Management's attitude to safety on site is a major factor of influence to workers safety behaviour.						
10.Poor co-operation between sub-contractors on site undermines safety.						

SECTION FOUR:PROCEDURAL FACTORS(4).

NOTE;PLEASE TICK ONLY ONE SQUARE BOX [ ],FOR EACH QUESTION.

STATEMENT/OPINION	STRONGLY-AGREE	AGREE	DONT-KNOW	DISAGREE	STRONGLY-DISAGREE	ANY COMMENTS
1.Investigating Near-Accidents can lead to the prevention of future accidents.						
2.Pressure to get on with the job prevent managers from investigating near-accidents on site.						
3.It is not really possible for safety procedures in a job to be considered at tender stages.						
4.Firms ought to provide workers with all their safety equipment and weather-proof clothing,including boots.						
5.Anyone who repeatedly fails to wear their safety protective clothing and equipment ought to be sacked.						
6.Site managers must accept their responsibility for safe-working procedures and systems on their sites.						
7.Considering safe-procedures and systems of work at tender leads to improved safety performance.						
8.All workers in the building industry should be provided with safety booklets by their companies.						
9.Providing all workers with safety booklets would lead to a reduction of most accidents on site.						

PLEASE TURNOVER >

SECTION FIVE: TECHNICAL FACTORS(5)

NOTE: PLEASE INDICATE YOUR RESPONSES TO THE STATEMENTS/OPINIONS BELOW,
----- BY TICKING ONLY ONE SQUARE/BOX TO EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENT
1. Workers should refuse to operate items of plant or equipments for which they have received no operating and safety training.						
2. Most workers in the building industry lack knowledge of safety hazards on site.						
3. Workers ability to spot safety hazards on site would lead to less accidents.						
4. Most workers with commonsense could drive dumpers, fork-lifts, or other machines on site after a little site demonstration.						
5. A steady flow of safety information from management to workers is very lacking in the construction industry.						
6. Training of Safety Advisers in health and safety in the UK is inadequate for carrying out effective safety management.						
7. The wearing of safety protective clothing and equipment reduces workers efficiency.						
8. All Specialist sub-contractors, should supply method statement, and safety policies with their tenders.						
9. Present methods of tendering discriminate strongly against safety conscious contractors.						
10. Pressure and Tiredness lead to accidents on site.						

SECTION SIX; ORGANISATION AND MANAGEMENT FACTORS(6).

NOTE: PLEASE INDICATE YOUR ANSWERS TO THE STATEMENTS/OPINIONS BELOW, BY TICKING THE BOX, WHICH BEST DESCRIBES YOUR REACTION TO THEM. PLEASE TICK ONE BOX ONLY FOR EACH QUESTION.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. More accidents occur when worker-management relations are bad.						
2. Trade Union involvement with safety, can reduce accidents.						
3. Having Safety Representatives on sites, will not improve safety standards.						
4. Site Management and main board directors have responsibility for safety on sites.						
5. Management alone cannot prevent accidents on site, workers must play their part by working safely.						
6. Managers and supervisors do not talk to their workers enough, about Health and Safety on site.						
7. Having safety Committees in a company, improves safety standards in the organisation.						
8. More Factory Inspectors in the Building Industry cannot improve health and safety performance.						
9. Management safety attitudes determine worker's safety behaviour on site.						
10. Poor co-ordination of sub-contractor's work on site by main-contractors and managing contractors can influence safety performance.						

PLEASE TURNOVER >

SECTION SEVEN: ENVIRONMENTAL FACTORS(7)

NOTE: Please indicate your answers to the statements/Opinions made below, by ticking one box only to each question.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENTS
1. A single contractor responsibility for all scaffolding on site is important to the improvement of safety standards.						
2. Untidy building sites can lead to accidents occuring						
3. Provision of good quality welfare and first-aid facilities on site improves safety standards.						
4. Providing workers with thermal/warm clothings in winter could improve safe-working on sites.						
5. Good job planning, and site organisation, improves safety performance.						
6. An inadequate supply of the right type and quality tools, plants and equipment leads to accidents and damage on site.						
7. The attitude of older workers to safety and health is a major source of influence to new recruits in the building industry.						
8. Thermal discomfort of workers in the winter is not a major safety problem.						
9. Inadequate control and supervision of workers on site is a major factor in accident occurence.						
10. Workers can reduce the causes of some accidents on site by simply being a little more thoughtful about what they are doing.						

SECTION EIGHT: SAFETY PERFORMANCE FACTORS(8).

NOTE: YOU HAVE COME TO THE FINAL SECTION OF THIS QUESTIONNAIRE. PLEASE CONTINUE.

STATEMENT/OPINION	STRONGLY AGREE	AGREE	DONT KNOW	DISAGREE	STRONGLY DISAGREE	ANY COMMENT
1.Safety assessment of sites on very competitive and regular basis encourages safety awareness.						
2.The Health and Safety Inspectorate have inadequate resources to enforce safety in the construction industry.						
3.Hazard identification or Hazard seeking,ought to be conducted regularly by site managers.						
4.Efficient hazard identification is a key factor in encouraging effective safety performance.						
5.Displaying all accident information on sites would prevent risk-taking by workers.						
6.Alcohol and drugs are not major problems for safety on site.						
7.All companies in the building industry should have alcohol and drug policies.						
8.Lack of safety consultation between Clients,Engineers,Designers,Managing Contractors and Sub-contractors undermines safety performance on contracts.						
9.Safety provisions in tender documents are too vague for promoting better safety on site.						
10.Most accidents occur on multi-occupied sites due to inadequate control of sub-contractors.						

MANY THANKS FOR YOUR PATIENCE,AND CO-OPERATION.
EDWIN.

Pilot Safety Study - Comments by V. C. Morrill - Bovis Snr. Site Manager

Page 1

Format messy , I would suggest the following example:

(1) What type of Company do you work for?

Please tick box

a) Main Contractor ☐

b) Sub-Contractor ☐

c) Etc.

(2) to (8) Inclusive ditto, ditto.

Page 3

Item 9 & 10 close together

Page 4

Layout good

Page 5

High

Generally questions quite good.

All the rest OK.

APPENDIX- J.

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APPENDIX-J.

Attitudes to Safety Representatives and Committees on Construction Sites

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1. Introduction

Over the last 20 years there has been increasing concern for the maintenance of safe working environments in industry. Construction has not been exempt from the pressures of safer working — indeed many would argue that the relatively poor record of the construction industry in providing safe conditions makes it a focus for discussion. The thrust of forcing safety improvements has lain with the Health and Safety at Work Act of 1974 which sought to make industry more self-regulating in respect of safety management.

The background to this philosophy has been based on an ever-increasing set of statutory regulations regarding safety, and the Robens Report[1] sought to evaluate this plethora of legislative intervention. Robens found that new hazards and problems based around modern processes and materials were leading to declining standards of health and safety.

Moreover, problems eschewed detailed machinery, procedures and inspections by individual factory inspectors and saw benefit in developing well-regulated, disciplined employers or employees to guard against breaches of safety. This process of self-regulation placed greater emphasis on employers and training agencies to stimulate safety training. To this end the BEC/CITB encouraged a series of safety training seminars to fit in with the spirit of the Robens Report and the subsequent legislation. The Health and Safety at Work Act 1974 presaged longer-term objectives which were to change attitudes to safety so that this became part of the normal practice of working behaviour. One of the instruments to achieve these objectives and procedures was the introduction of a system of Safety Committees and Safety Representatives in 1978.

It will be recalled that the regulations prescribed the cases in which trade unions may have appointed safety representatives and the functions of such people. Additionally the regulations set down the instances where an employer needed to establish a safety committee. Cradduce[2], in his paper "Safety Representatives", reviewed the impact of the regulations on the construction industry and noted the particular difficulty in respect of subcontractor involvement in safety management. Some five years after the introduction of the Safety Committee and Safety Representative regulations became law the CSU (Construction Study Unit) at Brunel University sought to study the level of implementation and the effects on construction of this legislative intervention.

At a basic level the consequences of the legislation and the subsequent regulations can be monitored by the trends in accidents and particularly the accidents per 100,000 at risk could be indicative. As can be seen in Table I, despite the legislation the safety position has not improved. So, were other factors at work? The legislation set out to compare the safety climate by changing attitudes and the question remained, "was this happening?" Consequently, the aim of the research was to investigate the general attitudes of construction workers towards safety representatives and safety committees in the construction industry. Its premise was that favourable attitudes towards the introduction of such agencies may initiate positive attitudes towards general safety procedures in the construction industry.

Table I

	Rate of fatal accidents per 100,000 at risk	Rate of serious accidents per 100,000 at risk	Rate of all reported accidents per 100,000 at risk
1974	16.0	760	3460
1975	17.7	740	3460
1976	15.3	650	3530
1977	13.1	750	3300
1978	13.1	760	3400
1979	11.7	Not available	3150
1980	13.0	Not available	3000
1981	9.7	1687	4170
1982	9.9	1948	4060
1983	11.4	2176	Not available
1984	9.8	2191	Not available

2. The Sample

The research used three distinct data bases for the sample with differing research instruments. In order to obtain "official" views, organisations involved with the external management of health and safety were interviewed. this work supported the primary data drawn, by questionnaire, from operatives and supervisors in ten construction companies of varying size and regional origin. The companies involved in the survey were drawn from all sectors of the industry, and the sample was unstructured and random. Also the size of the organisations providing assistance varied (see Table II).

Table II

Number of Companies	Number of Employees
2	1 - 49
3	50 - 299
1	300 - 599
4	600+

The primary sample was the individual operative and site manager. Here the ten companies involved received 364 questionnaires to distribute to operatives and site-based supervisors and managers; again this was a random sample. Some 200 questionnaires were returned giving a response rate of 55 per cent. Of those returning the questionnaire, 85 per cent were employed by private and public liability companies, 9 per cent by statutory authorities and 2 per cent were self-employed. All had previous knowledge of the industry and Table III shows the distribution of experience of the respondents.

Table III

18% had less than 1 year's experience
29% had between 2-3 years' experience
13% had between 4-5 years' experience
18% had between 6-9 years' experience
22% had between 10-20 years' experience

As can be seen, the majority of the sample have cumulative experience of construction with its attendant work ethics and have been exposed to a construction work environment from 2 to 20 years. They therefore may be considered to have developed useful insights into the issue under investigation.

3. Results

3.1 Appointment of Safety Representatives and Safety Committees

All firms in the sample used safety officers and advisers, but it seems that the same enthusiasm has not been shown towards the selection or appointment of safety representatives and safety committees. The research showed that several of the sample companies (including the larger firms) did not use safety representatives and committees, irrespective of project sizes or types. Four firms in the sample did not have safety representatives and only one had any form of safety committee. Constrasting this sanguine approach to safety representatives, some 60 per cent of the individual respondents believed that the presence of safety representatives on sites would assist the construction industry to become more self-regulatory than it is at present. Further, their presence would lead to improvements in safety performance provided they were of the right calibre and trained to spot potential hazards. They were expected to be able to hold regular consultations on health and safety matters with supervisors, site management and operatives; and to be able to take part in arranged safety clinics on sites when necessary. Essentially operatives believed that safety representatives had a very important role to play in accident/hazard prevention at the workplace. It was thought that their presence would supplant the role of the Safety Inspectorate in the policing of safety in the construction industry. Again, the proviso attached to this role was that of adequate training to meet the needs for objective safety monitoring, safety control, safety supervision and safety reporting.

On the question of safety committees, 65 per cent of the respondents stated that their companies had no safety committees and 24 per cent did not know if they had them or not. However, the 11 per cent who had them thought them to be very effective in influencing company safety policies and overall safety management. They were thought of very highly by 40 per cent of the sample. Finally 53 per cent of respondents indicated that the introduction of both safety representatives and safety committees would greatly improve safety performance in the industry, through the creation of greater safety awareness and individual safety organisation at the workplace.

3.2 Willingness of Operatives and Trade Foremen to become Safety Representatives

The research showed that operatives and foremen were reluctant to become safety representatives. Of the operative sample, only 27 per cent were willing to become safety representatives, 56 per cent were unwilling and 17 per cent had no views either way.

It may be construed from this result that while most operatives, as shown in Section 3.1, may express highly favourable attitudes towards the idea of having safety representatives on every site/workplace in the industry they themselves were unwilling to accept responsibility for their own safety and that of their colleagues at work. Since the use of safety representatives is not voluntarist and is required by law, then management and trade unions have much to do to stimulate interest in this matter. Creative use of incentives may be usefully considered. Yet the picture is not entirely bleak, for while those willing to become safety representatives were in a minority, the reasons for wishing to become a representative were very encouraging.

Of those respondents who were willing to serve as safety representatives:

- 78 per cent thought Safety Representatives (SRs) were vital to the construction industry, in terms of accident prevention, and the creation of safety awareness within the operative groups;
- 4 per cent believed that SRs were essential to the company image and were "management men";
- 11 per cent felt they would be playing a useful role to themselves and their workmates by virtue of the safety knowledge they would get through safety training;
- 7 per cent thought that the job of safety representative was easier than normal working.

These responses indicate how aware the workforce was of the relevance of the role of the SR to industry, the company and themselves. The general view of SRs as union appointees and, as such, anti-management, was not borne out. On the other hand, management was more concerned that trade unions were reluctant to appoint SRs and give them the right sort of training. Management would prefer joint training for operatives, supervisors and appointed SRs rather than leaving it to trade unions.

3.3 Prevention of Accidents

The general view expressed by 86 per cent of the sample was that the presence on sites of well-trained and competent safety representatives would prevent the occurrence of most types of accidents. It must be stressed that the research did not seek to validate these feelings empirically but merely sought to record them. More pertinently, the sample felt that most accidents occur due to poor supervision, and these may be distinguished from those which may occur as a result of negligence or carelessness on the part of the individual.

The significance of this response is the psychological impact of the SR's presence which may create a favourable environment or atmosphere for a safer site, and this could be advantageous both to the company and the industry. Therefore trade unions should be encouraged, by management, to appoint more safety representatives and provide them with a joint TUC/employer training programme. This could lead to better understanding of safety and health problems by trade unions and employers' organisations.

3.4 General Safety Attitudes

Generally, most operatives' attitudes towards working in the construction industry appear to be favourable. The research showed that:

- 82 per cent of the operative sample expressed very high positive feelings towards their jobs and safety;
- 11 per cent expressed negative feelings;
- 7 per cent did not have any views as to the relevance of their jobs and safety.

Additionally the data revealed that:

- 9 per cent of operatives worked in construction, despite the safety record, because to them construction paid good money;
- 15 per cent worked in construction because they could not find other work;
- 33 per cent said they liked working in the open air;
- 7 per cent felt they found it easier to change jobs from one employer to another;
- 36 per cent worked in construction because they were following family tradition.

However, the most strongly expressed attitude by operatives was towards personal safety. Ninety-three per cent considered their safety as being the single most important factor to them at the workplace. Only 4 per cent thought safety was either irrelevant or unimportant.

Interestingly, the research confirmed that most operatives considered health and safety of great importance and felt that management did not do enough for them in the form of safety training. The research also showed that considerable apathy persists in the job situation: apathy is not conducive to good health and safety performances. However, the root cause of such views was shown to be the uncertainty about future employment in the industry and, at a more particular level, management attitudes to labour are seen to be developing an apathetic atmosphere within the labour force. On the other hand, if results of Carnegie's[3] research showing that "most men in construction look forward to going to work" are generally accepted, then men must be motivated by employers in an endeavour to reduce the expression of apathy. Hill and Trist[4], in their research on accidents, have shown that "Accidents may be considered as a means of withdrawal from the work situation, through which individuals may take up the role of absentees in a way acceptable to both himself and to his employing organisation". So, the apathy which is shown to prevail among construction workers may be tenuously linked with accident or safety performance for the reasons given above. Current research by the CSU is addressing this hypothesis.

3.5 Other Findings

Asked if operatives have heard about the 1974 Act, 87 per cent answered in the affirmative. Of the 87 per cent, 55 per cent heard of the Act through their trade union and not from their employer. Only 16 per cent said that they were informed by their employers, the rest were informed by their safety representatives, their fellow workers and other sources.

This finding shows the significant role of the trade unions in informing their membership of relevant legislation in safety, health and welfare in the workplace. On the basis of this result, it is suggested that both employers and the trade unions must work together more closely in promoting a better informed workforce in respect of health and safety. The research suggests that the objective of a self-regulating industry cannot be realised unless the workforce is made aware of its roles, duties and responsibilities towards safe conduct at work.

Training is seen as an important factor in the promotion of safety awareness and the creation of good safety attitudes. Notwithstanding this observation, only 47 per cent of operatives had received safety training, while 53 per cent had no training in health and safety. Some management respondents indicated that "more often than not", commercial forces dictated the level of training provision.

The research showed that while management was willing to co-operate with safety representatives, 51 per cent of them did not feel that safety representatives had any legal responsibility for safety on site. Nevertheless, 64 per cent believed that the role of safety representative on sites could reduce accident occurrence, but were happy to do without them. They blamed trade unions for failing to appoint safety representatives, despite Section 2 of the Act, which imposes duties on employers to consult with the employees' safety representative, under the Safety Representative and Safety Committee's Regulation of 1977[5].

Conclusion

Despite the relatively low-key discussion of safety committees and safety representatives it is clear that their introduction has had some impact on attitudes to safety in construction. The research carried out indicated that despite initial scepticism there is a general, if unfocused, belief that safety committees and safety representatives contribute to a better safety climate on construction sites. However, the data distinguish between the responses made; safety representatives were regarded as having greater impact ("highly favourable" response) than safety committees which were judged to be only "moderately" influenced. It is worth noting that these responses were bipartheid in that both employers and employees recorded the same view. Several reasons for the differences of attitude to representatives and committees may be postulated. The most obvious is the human dimension — representatives are real people while committees are seen as bureaucratic instruments. Secondly, the form of action for corrective measures in the event of breaches or rectifying dangerous situations may be with representatives rather than committees. Having noted these attitudinal responses it can be restated that the research sought to test if the intervention of the law had improved safety performance. The results suggest that there is no clear evidence to support the hypothesis that there is a relationship between attitudes (to safety committees and safety representatives) and safety performance. However, more subtle influences may be at work which are shaping attitudes to safety. Firstly the research indicated that attitudes to safety are key variables in the *attention* paid to health and safety at work and this process is evident in the pre-site planning and the execution of construction work. Secondly the evidence suggests that while accident data have not shown improvements there has been a concerted effort to develop a co-operative attitude to the management of safety. Management, trade unions, the Health and Safety Inspectorate and Safety Committee and representatives appear to be committed to improvement and the 1977 regulations seem to have galvanised this effort.

Thirdly the research noted that the concern of operatives for their own safety was of supreme importance. This finding is tenuously linked to the work of the safety agencies and the safety committees and SRs. In short it is a reflection of the growing (positive) attitude of construction operatives to safety and vindicates the philosophy of the 1974 Act and the subsequent Safety Representative legislation.

To conclude, this small-scale pilot study cannot claim to have uncovered conclusive evidence regarding the relationship between safety representatives and committees and performance. However, this research provided the springboard for more extensive work in the area of safety management. This work is currently being conducted at Brunel and will be reported in due course.

References

1. Robens, A., *Report of Committee on Safety and Health*, HMSO, 1972.
2. Cruddace, B.D., "Safety Representatives", *CIOB Site Management Information Service*, No. 77, Spring 1979.
3. Carnegie, J.F., "The Nature and Causes of Casual Employment in the Building Industry and the Prospect for Change", MSc thesis submitted to the Department of Building, Heriot-Watt University, 1976 (unpublished).
4. Hill, J.M.M. and Trist, E.L., "A Consideration of Industrial Accidents as a Means of Withdrawal from the Work Situation", *Human Relations*, Vol. 6, 1953, p. 357-80.
5. *Safety Representatives and Safety Committees, Regulations 1977-8*, HMSO, 1977.

APPENDIX : K:

RESULTS OF OPERATIVE DATA

1. Correlation Coefficient Matrix
2. Chi-Square Test Results

Appendix K1

Variable	age	service	industry	money	banksman	bonus	blindeye	reduce	risks	product
age	1.00000									
service	0.50673	1.00000								
industry	0.80408	0.43874	1.00000							
money	0.08578	0.15914	0.20282	1.00000						
banksman	-0.05206	0.00470	-0.05662	-0.00941	1.00000					
bonus	-0.02231	-0.28722	-0.11073	-0.17570	-0.03412	1.00000				
blindeye	0.04690	-0.11970	0.05731	0.01625	0.11536	0.52234	1.00000			
reduce	-0.07580	-0.06599	-0.01579	0.32920	0.10040	-0.02129	0.22704	1.00000		
risks	-0.06463	-0.11241	-0.07134	-0.10198	-0.03442	0.09181	0.10720	-0.03977	1.00000	
product	-0.17256	-0.13408	-0.05175	0.07960	0.10511	-0.04928	-0.11406	-0.00543	-0.04711	1.00000
cares	-0.12788	-0.14539	-0.11299	-0.11542	-0.13170	-0.12399	-0.19701	-0.02166	-0.01004	0.15061
safety	-0.05757	-0.09724	-0.01610	0.09005	-0.10258	0.01474	-0.03334	0.00536	-0.09305	0.32544
workmate	-0.01850	-0.12787	-0.05605	0.14335	0.05223	0.15782	0.19959	0.19517	0.01548	-0.19611
safeact	-0.05738	0.06247	0.00208	0.11750	0.02147	-0.06253	-0.06341	0.14179	-0.13322	0.26091
training	-0.03100	0.06842	-0.00120	0.09263	-0.16921	-0.13572	-0.06166	0.04025	-0.04854	0.38992
risky	0.23137	0.08971	0.26350	0.00854	-0.06964	0.02443	0.07701	-0.11255	0.26461	-0.09434
skillful	-0.04934	0.08034	-0.02322	-0.21417	-0.09318	0.06528	0.06441	0.02795	-0.15689	0.00860
careful	-0.04961	0.00956	-0.07217	-0.00759	-0.02054	-0.12023	-0.06951	0.15760	0.06491	-0.05510
site	0.17862	0.02975	0.09273	-0.08224	-0.01957	0.14865	0.19395	0.15469	-0.04510	-0.16443
like	-0.05863	-0.08130	-0.08903	0.01915	-0.03735	-0.12060	-0.07675	0.04152	-0.04563	0.20893
helmet	0.01167	0.01182	0.07271	0.14313	0.05100	0.05072	0.07942	0.10742	-0.10961	0.20489
wear	-0.13090	-0.01808	-0.12438	-0.00958	0.02259	0.04105	-0.03683	-0.05594	0.03099	0.19182
protect	-0.01175	0.01764	0.01276	0.17112	0.04440	0.07220	0.01863	0.12248	-0.06067	0.30741
equip	-0.11997	-0.02757	-0.11888	0.09339	-0.13820	0.17954	0.05677	0.15505	-0.01734	0.18433
safebook	-0.06581	0.00213	-0.14571	0.05081	-0.10830	0.11208	0.01436	0.21819	-0.04972	0.12853
talk	-0.06326	-0.00475	-0.12601	0.08139	-0.08455	0.15052	0.07292	0.29219	0.00831	0.08970
believe	-0.01929	-0.10634	-0.00253	0.05041	-0.02947	0.15258	0.11776	0.25643	-0.10510	0.20682
asbestos	-0.11107	-0.14888	-0.09022	-0.00449	-0.23005	0.09251	0.08685	-0.02584	0.07683	0.05573
asbesite	-0.11592	-0.00048	-0.09341	0.13368	0.04413	0.08154	0.01201	0.14137	-0.01629	0.09143
handle	-0.04943	-0.06201	-0.14738	0.08341	0.18191	-0.03727	-0.01471	0.14606	-0.14150	0.32103
tell	-0.02663	0.03559	-0 00129	0.04083	0.04041	-0.12077	-0.08938	-0.07071	0.08659	-0.08332
mechan	-0.03686	0.04886	-0.05654	0.04637	-0.03977	0.01974	0.06072	-0.13050	-0.02663	0.19125
scaffold	-0.08292	0.00663	-0.15100	0.03079	-0.11105	0.01413	0.02155	0.05006	0.02456	0.09650
proper	0.07045	0.09944	0.09204	0.00623	0.09313	-0.15655	-0.13292	0.07873	-0.06284	-0.21880
sense	-0.01985	0.08339	0.04311	0.04994	0.18741	-0.17066	-0.09068	-0.00703	0.07171	-0.14707
erector	-0.04232	-0.05103	-0.00672	0.07802	0.05343	-0.11868	0.07921	0.02997	0.11381	-0.03825
dumper	0.11715	0.16530	0.11373	0.04279	0.08023	-0.04008	0.08518	-0.02475	-0.02526	-0.09248
operate	-0.04008	0.01894	-0.14856	-0.00613	-0.00257	-0.01669	0.03414	0.12504	0.14169	0.22989
relation	-0.01347	0.16178	-0.08312	0.01733	-0.03932	0.00324	0.09193	0.06158	0.07877	0.04484
involve	0.00991	0.00437	0.01922	0.24547	0.04318	-0.08089	0.09033	0.21932	-0.15487	-0.05230
subcont	-0.13850	0.02344	-0.14445	0.05561	0.07664	0.08548	0.17915	0.19198	0.01065	0.21248
saferep	-0.01203	0.01910	-0.09174	0.19294	-0.06598	-0.12085	0.00411	0.23282	-0.11879	0.23368
cooperat	-0.03190	0.01774	-0.12252	0.01963	-0.17068	0.11846	-0.08522	-0.00393	0.03207	0.09586
commitee	-0.06444	0.03571	-0.05475	0.04145	-0.07048	-0.16799	-0.16782	0.09230	-0.18202	0.24402
enough	-0.10168	-0.09859	-0.09292	-0.11094	-0.08213	-0.14803	-0.25629	-0.00450	-0.01148	0.16383
superv	0.10901	0.05112	0.05512	0.06696	-0.02103	0.07269	0.29209	0.24179	0.07952	-0.12487
posters	0.00128	0.01431	-0.04207	0.06141	0.03092	0.03051	0.03903	0.09670	-0.17522	0.31849
tidysite	-0.01987	0.12187	-0.15488	0.06562	0.04181	0.03379	-0.08198	0.05276	-0.06461	0.33590
jobs	0.07962	0.10480	0.05021	0.11432	-0.08125	-0.06673	-0.06972	0.11767	0.00750	-0.00388
cause	-0.07569	-0.05992	-0.00721	-0.11663	-0.16373	-0.12639	-0.16358	0.00678	0.08793	-0.12099
lessacci	0.05440	0.10632	0.01511	0.04298	0.04396	0.05858	0.03799	-0.01165	-0.12709	0.19522
toxic	-0.02798	-0.01167	-0.07053	0.08833	-0.12512	-0.11306	0.17408	0.16154	-0.01011	0.02372
examples	0.11996	0.13679	0.06154	-0.20173	-0.09433	0.05712	0.03511	-0.12532	0.14248	-0.06479
plan	-0.04296	0.22401	-0.02777	0.07657	-0.02859	-0.07848	-0.00668	0.01014	-0.10348	0.27998
avoid	-0.05817	0.09095	-0.02641	0.09202	0.05382	-0.09134	0.08455	0.15023	-0.04698	0.16939
safeinsp	-0.07572	0.07101	-0.05320	-0.03285	-0.08394	-0.19892	-0.12981	0.06419	0.02955	-0.02808

Appendix K1

Variable	cares	safety	workmata	safeact	training	risky	skillful	careful	site	like
age										
service										
industry										
money										
banksman										
bonus										
blindeye										
reduce										
risks										
product										
cares	1.00000									
safety	0.20147	1.00000								
workmata	0.07386	-0.13382	1.00000							
safeact	0.31415	0.12127	-0.00811	1.00000						
training	0.21411	0.39539	-0.10638	0.39517	1.00000					
risky	-0.11989	0.01344	0.10690	-0.30561	-0.07419	1.00000				
skillful	-0.00624	0.33137	-0.02622	0.09039	0.24921	-0.02370	1.00000			
careful	0.13545	0.13278	-0.05788	0.20126	0.18964	-0.03141	0.29778	1.00000		
site	-0.08860	-0.07869	0.11078	-0.11775	-0.01977	-0.05595	-0.01086	-0.14224	1.00000	
like	0.16430	0.50506	-0.11383	0.12660	0.29570	0.01669	0.25042	0.38675	-0.24551	1.00000
helmet	0.18541	0.33324	0.03100	0.19153	0.30249	-0.21099	0.17888	0.02439	0.05199	0.08844
wear	0.09414	0.00641	0.02623	0.07986	0.18887	-0.09484	0.02658	0.09183	0.06418	-0.08937
protect	0.20376	0.17522	-0.03234	0.21252	0.18934	-0.09562	-0.16953	0.09366	-0.08626	0.03615
equip	0.18482	0.18282	0.07072	0.20728	0.27478	-0.14918	0.07065	0.18374	0.04072	-0.04613
safebook	0.12721	0.12142	0.16590	0.20406	0.24469	-0.09382	0.00000	0.03849	0.03544	-0.06276
talk	0.09774	0.15681	0.20243	0.15305	0.23520	-0.12569	0.01935	0.15530	0.08154	-0.00063
believe	-0.01045	0.22058	0.14589	0.01518	0.17855	-0.12946	0.14983	0.00368	0.05166	0.02413
asbestos	0.15773	0.44064	-0.11593	-0.04039	0.24721	0.04331	0.06942	0.13141	-0.05980	0.36203
asbesite	-0.08024	0.06178	0.12618	0.10954	-0.01783	-0.07605	-0.02167	-0.17329	0.01249	-0.01627
handle	0.18408	0.02448	-0.03725	0.20509	0.18110	-0.14286	-0.21431	-0.04010	0.11245	0.07278
tell	0.12892	-0.05232	0.01326	-0.09858	-0.16168	0.05431	-0.12321	0.08087	-0.01309	0.01207
mechan	-0.00887	0.44245	-0.13056	0.07453	0.32365	0.01565	0.23888	0.08666	-0.22154	0.38868
scaffold	-0.08469	0.37420	0.02528	0.04204	0.35242	-0.01825	0.19214	0.15147	-0.06513	0.30792
proper	-0.01461	-0.07051	0.27564	-0.17782	-0.06594	0.09440	-0.05927	0.10770	0.16803	-0.12528
sense	0.00627	-0.25632	0.02636	-0.12394	-0.27974	0.12936	-0.06679	0.05444	0.11652	-0.28997
erector	0.05625	-0.29651	0.17717	-0.07282	-0.14022	0.05364	-0.29149	-0.02803	0.00485	-0.24025
dumper	0.06193	-0.12912	-0.12110	-0.03495	-0.09226	0.08407	-0.03815	-0.07565	0.00545	-0.17414
operate	0.05575	0.18403	-0.08778	0.09574	0.26939	-0.19961	0.05833	0.03453	-0.09722	0.16541
relation	-0.12075	-0.10313	0.00407	-0.08464	0.07552	-0.00714	0.02061	-0.02464	0.11280	-0.14221
involve	-0.02382	-0.09014	0.06747	0.15767	0.01060	-0.28764	-0.05003	0.14968	0.02481	-0.03293
subcont	-0.00239	-0.00087	0.09199	0.14862	0.14833	-0.11379	0.01322	0.02271	0.04294	-0.04014
saferep	-0.01303	0.14232	-0.10918	0.16120	0.20687	-0.31260	-0.00450	0.03195	-0.05906	0.09293
cooperat	0.10105	0.17307	-0.08106	-0.00181	0.07924	0.01597	-0.07934	0.09710	-0.11130	0.33348
commitee	0.13526	0.13639	-0.05641	0.22645	0.38111	-0.26108	0.07885	0.15303	-0.08966	0.05727
enough	0.38989	0.11702	0.07809	0.07333	0.07118	-0.08798	0.03921	0.08509	0.02115	0.04852
superv	0.00306	-0.07840	0.29850	0.05444	0.00285	0.01850	-0.06576	0.06999	0.21989	-0.11128
posters	0.23090	0.16716	0.05764	0.21509	0.22130	-0.17967	-0.00429	-0.09618	0.05492	0.07135
tidysite	0.06458	0.16715	-0.04949	0.20207	0.34005	-0.17526	0.13373	0.06423	0.01562	0.15060
jobs	0.03657	0.14025	0.06898	0.02471	0.08277	0.02188	0.01942	0.05833	-0.04736	0.01939
cause	0.08123	-0.13696	0.04264	0.06519	-0.09670	0.00897	0.03547	0.03617	0.16037	-0.07820
lessacci	0.05517	0.20914	0.03950	0.11483	0.17833	-0.24044	0.11922	-0.00810	-0.12720	0.09534
toxic	-0.12970	0.09426	0.03359	0.03891	-0.06364	0.01904	-0.03983	0.11961	-0.01529	0.08002
examples	0.13544	0.24226	0.02682	-0.08491	0.19491	0.12095	0.07994	0.09976	0.16536	0.11012
plan	0.16678	0.19127	-0.03804	0.19247	0.20543	-0.08912	0.12315	0.08978	-0.24995	0.08337
avoid	0.06441	0.16982	0.11363	0.01262	0.16837	-0.03278	0.04030	0.08001	-0.10699	0.06108
safeinsp	0.09596	-0.13121	-0.01028	0.15626	0.04243	-0.07765	-0.03534	0.15738	-0.04731	0.04474

Variable	helmet	wear	protect	equip	safebook	talk	believe	asbestos	asbesite	handle
age										
service										
industry										
money										
banksman										
bonus										
blindeye										
reduce										
risks										
product										
cares										
safety										
workmata										
safeact										
training										
risky										
skillful										
careful										
site										
like										
helmet	1.00000									
wear	0.08531	1.00000								
protect	0.41424	0.23132	1.00000							
equip	0.36994	0.35777	0.66292	1.00000						
safebook	0.27205	0.38101	0.56355	0.67155	1.00000					
talk	0.37590	0.40605	0.60095	0.72488	0.80281	1.00000				
believe	0.31044	0.26955	0.35862	0.44018	0.53765	0.63464	1.00000			
asbestos	0.16325	0.03725	0.12720	0.20286	0.15169	0.17380	0.09728	1.00000		
asbesite	-0.03782	-0.03469	0.10694	0.03293	0.03425	0.04239	0.08194	-0.00796	1.00000	
handle	0.13345	0.08376	0.24928	0.13318	0.10624	0.17760	0.03931	0.14893	0.26628	1.00000
tell	-0.19612	-0.17290	-0.03431	-0.19403	-0.21826	-0.26853	-0.26421	-0.16440	0.06369	-0.07166
mechan	0.27778	0.08510	0.11256	0.11309	0.23990	0.14627	0.17054	0.27350	-0.11305	-0.04096
scaffold	0.10972	0.30654	0.15568	0.25721	0.34331	0.34198	0.32453	0.50649	0.09425	0.10701
proper	-0.19272	0.06439	-0.11472	-0.10696	-0.06288	-0.01187	0.07242	-0.12985	-0.07736	-0.18482
sense	-0.05265	0.01527	-0.10228	-0.14209	-0.09111	-0.08757	-0.15067	-0.21479	0.04358	0.03217
erector	-0.14770	-0.03030	-0.02931	-0.09463	-0.04963	-0.03902	0.01978	-0.16054	0.17199	0.07748
dumper	0.01181	-0.15195	0.08331	-0.01932	-0.06718	-0.08125	-0.06366	-0.16445	-0.05127	0.00962
operate	0.23399	0.09171	0.20594	0.30136	0.33988	0.28845	0.11388	0.10116	-0.11045	0.10634
relation	0.04386	0.29926	0.13325	0.11023	0.27111	0.21735	0.06570	0.00066	0.08337	-0.01866
involve	0.10703	0.12489	0.15464	0.09756	0.12438	0.17421	0.16193	-0.01245	0.10454	0.06551
subcont	0.11501	0.20637	0.04725	0.10247	0.24133	0.24063	0.26673	0.14715	-0.07580	0.13317
saferep	0.24841	0.19593	0.32141	0.22963	0.38503	0.39367	0.36407	0.12614	0.01887	0.21145
cooperat	-0.01182	0.16917	0.17471	0.26949	0.33487	0.32188	0.20013	0.28569	-0.07396	0.11488
commitee	0.15982	0.33247	0.23480	0.34748	0.32992	0.34296	0.37395	0.13222	0.18928	0.20899
enough	-0.03673	0.17730	0.00364	0.03575	0.05788	0.08368	0.09419	0.14418	0.05483	0.07754
superv	-0.04852	-0.02651	0.11189	0.13989	0.25732	0.23826	0.08060	-0.06383	0.10679	-0.10052
posters	0.18207	0.23227	0.11253	0.18533	0.31596	0.17982	0.26940	0.03088	-0.08487	0.11564
tidysite	0.27104	0.14909	0.22185	0.33529	0.26058	0.32352	0.23701	0.17048	0.05921	0.30774
jobs	-0.03476	0.04396	0.16651	0.24429	0.17404	0.22838	0.16968	0.08108	0.09339	-0.08031
cause	-0.18136	0.06452	-0.12399	-0.07741	-0.00600	-0.03959	-0.05888	-0.09650	0.05651	0.00661
lessacci	0.33225	0.00974	0.23763	0.15269	0.20262	0.17243	0.05250	0.10132	-0.03890	0.04101
toxic	-0.08624	-0.18177	0.06901	0.02091	0.12152	0.08832	0.07686	0.15878	0.10566	0.13936
examples	0.10532	0.04844	0.08297	0.06438	0.21635	0.17651	0.06354	0.31141	-0.12109	-0.01969
plan	0.22519	0.21489	0.37718	0.43936	0.37352	0.34498	0.18635	0.15164	-0.03444	0.04575
avoid	0.12739	0.16656	0.09013	0.24497	0.09324	0.16511	0.14571	0.24109	0.09929	0.04555
safeinsp	-0.12283	-0.02318	0.06203	0.02261	0.04019	-0.00526	0.00975	-0.11864	-0.12466	-0.12066

Variable	tell	mechan	scaffold	proper	sense	erector	dumper	operate	relation	involve
age										
service										
industry										
money										
banksman										
bonus										
blindeye										
reduce										
risks										
product										
cares										
safety										
workmata										
safeact										
training										
risky										
skillful										
careful										
site										
like										
helmet										
wear										
protect										
equip										
safebook										
talk										
believe										
asbestos										
asbesite										
handle										
tell	1.00000									
mechan	-0.12350	1.00000								
scaffold	-0.34782	0.51094	1.00000							
proper	0.24738	-0.32283	-0.04082	1.00000						
sense	0.24028	-0.21250	-0.28522	0.16391	1.00000					
erector	0.11012	-0.32282	-0.23688	0.15666	0.28645	1.00000				
dumper	0.16543	0.00339	-0.27528	0.08795	0.33888	0.34862	1.00000			
operate	-0.21078	0.45255	0.31178	-0.30580	-0.28594	-0.20622	-0.10839	1.00000		
relation	0.02085	0.12315	0.13512	-0.00184	0.07460	0.13484	0.01499	0.21898	1.00000	
involve	0.01326	-0.02966	0.07991	0.03813	0.00838	0.08779	-0.17697	0.04171	0.06726	1.00000
subcont	-0.19972	0.21634	0.26423	-0.11062	-0.03989	0.01328	-0.13887	0.28240	0.23137	0.15756
saferep	-0.23598	0.22556	0.36375	-0.06622	-0.07236	-0.09189	0.01402	0.35208	0.18252	0.46795
cooperat	-0.04925	0.32039	0.31281	-0.28008	-0.21588	-0.19245	-0.12050	0.24620	0.10368	-0.05541
commitee	-0.15814	0.07713	0.30296	0.06707	-0.19823	0.04241	-0.17496	0.14081	0.12232	0.36358
enough	0.01391	-0.04564	0.13299	0.08350	-0.07169	0.13469	-0.14419	0.18345	0.14465	0.02109
superv	0.05753	-0.08248	-0.05939	0.19997	0.02784	0.13097	0.04496	0.03929	0.09750	0.19835
posters	-0.17567	0.18789	0.05713	-0.01054	-0.06046	-0.02032	-0.00975	0.33969	0.15936	0.08810
tidysite	-0.05960	0.33890	0.27434	-0.11187	-0.23533	-0.21150	-0.06309	0.37275	0.08713	0.05216
jobs	-0.02638	-0.11326	0.16918	0.16373	-0.06248	0.04581	-0.20552	0.07344	0.20385	0.10905
cause	0.08249	-0.39108	-0.18908	0.11150	0.09727	0.19884	-0.04903	-0.28234	-0.01881	0.00150
lessacci	-0.10339	0.28623	0.14663	-0.11873	-0.10275	-0.13080	-0.00408	0.37484	0.19445	0.22020
toxic	-0.01623	0.11334	0.10803	-0.08644	0.05098	0.07822	0.09993	0.05508	0.04809	0.14520
examples	0.11670	0.15781	0.13702	0.04726	0.12058	0.01310	0.14059	0.15131	0.10318	-0.14092
plan	-0.00697	0.26282	0.16500	-0.13976	0.03231	-0.03433	0.04349	0.21613	0.13755	0.12790
avoid	-0.12733	0.14540	0.28166	0.04110	0.03474	0.04889	-0.09559	0.10311	0.11218	0.14517
safeinsp	0.03468	-0.27586	-0.12722	0.12863	-0.00748	0.12492	-0.01216	-0.05483	0.13411	-0.01387

Appendix K1

Variable	subcont	saferep	cooperat	commitee	enough	superv	posters	tidysite	jobs	cause
age										
service										
industry										
money										
banksman										
bonus										
blindeye										
reduce										
risks										
product										
cares										
safety										
workmata										
safeact										
training										
risky										
skillful										
careful										
site										
like										
helmet										
wear										
protect										
equip										
safebook										
talk										
believe										
asbestos										
asbesite										
handle										
tell										
mechan										
scaffold										
proper										
sense										
erector										
dumper										
operate										
relation										
involve										
subcont	1.00000									
saferep	0.24518	1.00000								
cooperat	0.29305	0.23918	1.00000							
commitee	0.10763	0.33751	0.21390	1.00000						
enough	0.04835	0.03289	0.08394	0.17364	1.00000					
superv	0.11545	0.03636	-0.19683	-0.01482	-0.13356	1.00000				
posters	0.26966	0.35618	0.13441	0.14712	0.14361	0.05786	1.00000			
tidysite	0.21249	0.23284	0.28994	0.30191	0.08458	-0.02688	0.21492	1.00000		
jobs	-0.04274	0.06558	0.12980	0.14373	0.10556	0.02758	0.02001	0.19098	1.00000	
cause	-0.08940	-0.02938	-0.09159	-0.04525	0.16448	0.03432	-0.08178	-0.34776	-0.32331	1.00000
lessacci	0.09408	0.28714	0.04069	0.22113	-0.00274	0.01952	0.10351	0.33431	0.30468	-0.43487
toxic	0.12357	0.14144	-0.03017	0.07891	-0.18672	0.23445	0.07900	0.03906	-0.04409	-0.05208
examples	0.15208	0.00603	0.14524	-0.05202	0.05442	0.03308	0.07162	0.08277	-0.03725	0.11187
plan	0.20282	0.19671	0.17317	0.23087	0.06133	0.16285	0.22166	0.36728	0.32278	-0.17177
avoid	0.18665	0.10593	0.06184	0.27144	0.13480	-0.03386	0.14178	0.29807	0.32631	-0.20419
safeinsp	-0.04126	0.08754	-0.09323	0.00528	0.07195	0.11062	0.11623	-0.26158	-0.10653	0.43557

Appendix K1

Variable	lessacci	toxic	examples	plan	avoid	safeinsp
age						
service						
industry						
money						
banksman						
bonus						
blindeye						
reduce						
risks						
product						
cares						
safety						
workmata						
safeact						
training						
risky						
skillful						
careful						
site						
like						
helmet						
wear						
protect						
equip						
safebook						
talk						
believe						
asbestos						
asbesite						
handle						
tell						
mechan						
scaffold						
proper						
sense						
erector						
dumper						
operate						
relation						
involve						
subcont						
saferep						
cooperat						
commitee						
enough						
superv						
posters						
tidysite						
jobs						
cause						
lessacci	1.00000					
toxic	-0.08542	1.00000				
examples	0.14963	0.06562	1.00000			
plan	0 44481	0.01877	0.24855	1.00000		
avoid	0.33068	0.04798	0.07979	0.46903	1.00000	
safeinsp	-0 30855	0 08827	0.05538	-0.10139	-0 10912	1.00000

ECONOMIC FACTORS - C4 = C10

TABLE 4.6: Correlation of Relationship betwen paying danger money, and Safety Performance (Accident) = 0.366 - Corre C124 and C301 = 0.366

'Danger Money'	Accident Performance		
Rows : C124	Columns : C301		
	1	2	ALL
1	30	2	32
2	0	62	62
3	19	13	32
ALL	49	75	126

Chi-Square = 85.63; df = 2, sign at $p<0.001$

TABLE 4.17: Correlation of 'Banksman Training and Safety Performance = 0.029

'Banksman Training'	Safety Performance		
Rows : C125	Columns : C301		
	1	2	AL
1	22	27	49
2	10	33	43
3	17	17	34
ALL	49	77	126

Chi-Square = 6.93; df = 2, $p<.05$

TABLE 4.18: Correlation of 'Bonus Payments' and Safety Performance (Supervisory Behaviour) = 0.701

Bonus and 'Blind eye'	Safety Performance		
Rows : C127	Columns : C01		
	1	2	AL
1	39	0	39
2	26	67	93
3	0	10	10
ALL	49	77	126

Chi-Square = 47.18; df = 2, $p<.001$

TABLE 4.19: Correlation of 'Safety Bonus' and Safety Performance = 0.839

Safety Bonus	Safety Performance		
Rows : C128	Columns : C301		
	1	2	ALL
1	39	0	39
2	10	66	76
3	0	11	11
ALL	49	77	126

Chi-Square = 89.46; df = 2, Significant at p = 0.001

TABLE 4.20: Correlation of 'Risk-taking' and Safety Performance = 0.784

Risk-Taking	Safety Performance		
Rows : C129	Columns : C301		
	1	2	ALL
1	43	10	53
2	6	61	61
3	0	6	6
ALL	49	77	126

Chi-Square = 68.88; df = 2, p<.001

PSYCHOLOGICAL FACTORS - C5 = C10

TABLE 4.22: Correlation of 'Care for Personal Safety' and Safety Performance = 0.718

Personal Safety	Safety Performance		
Rows : C132	Columns : C301		
	1	2	ALL
1	46	6	52
2	3	63	69
3	0	8	8
ALL	49	77	126

Chi-Square = 91.62; df = 2; p<0.001

TABLE 4.23: Correlation of 'Care for Workmates' Safety' and Safety Performance = 0.143

Workmates' Safety	Safety Performance		
Rows : C133	Columns : C301		
	1	2	ALL
1	4	6	10
2	27	31	58
3	18	40	58
ALL	49	77	126

Chi-Square = 2.94; df = 2, not significant p = 0.100

TABLE 4.24: Correlation of 'Health & Safety Act, 1974' and Safety Performance = 0.768

1974 Safety Act	Safety Performance		
Rows : C134	Columns : C301		
	1	2	ALL
1	40	0	40
2	9	63	72
3	0	14	14
ALL	49	77	126

Chi-Square = 92.86; df = 2, p=0.001

TABLE 4.25: Correlation of 'Safety Training' and Safety Performance = 0.244

Safety Training	Safety Performance		
Rows : C135	Columns : C301		
	1	2	ALL
1	24	17	41
2	23	52	75
3	2	8	10
ALL	49	77	126

Chi-square = 10.29; df = 2, p<0.01

NOTE: 1 cells with expected counts less than 5.0

p<.01

TABLE 4.26: Correlation of 'Construction as a tough and Dangerous industry, and preparedness to take risks' and safety performance = 0.461

Experience and Skill of worker	Safety Performance		
Rows : C137	Columns : C301		
	1	2	ALL
1	34	4	38
2	13	59	72
3	2	14	16
ALL	49	77	126

Chi-square = 58.75; df = 2, p=0.001

TABLE 4.28: Correlation of 'Supervisor carefulness behaviour' and Worker Safety Performance = 0.507

Supervisor Carefulness	Safety Performance		
Rows : C138	Columns : C301		
	1	2	ALL
1	32	2	34
2	12	63	75
3	5	12	17
ALL	49	77	126

TABLE 4.29: Correlation of 'Workmates' Carelessness about Safety' and Safety Performance = 0.039

Workmates' Carelessness	Safety Performance		
Rows : C139	Columns : C301		
	1	2	ALL
1	11	16	27
2	2	10	12
3	36	51	87
ALL	49	77	126

Chi-Square = 2.76; df = 2, p<0.10 not significant

NOTE: 1 cells with expected counts less than 5.0

TECHNICAL FACTORS - C6 = C10

TABLE 4.30: Correlation of 'Asbestos Awareness' as a health Hazard' and Safety Performance = 0.817

Asbestos Awareness	Safety Performance		
Rows : C147	Columns : C301		
	1	2	ALL
1	47	0	47
2	2	75	77
3	0	2	2
ALL	49	77	126

Chi-Square = 117.80; df = 2, p<0.02

NOTE: 2 Cells with expected counts less than 5.0

TABLE 4.31: Correlation of 'Asbestos Recognition' and Safety Performance = 0.604

Asbestos Recognition	Safety Performance		
Rows : C148	Columns : C301		
	1	2	ALL
1	35	6	41
2	12	52	64
3	2	19	21
AL	49	77	126

Chi-Square = 55.81; df = 2, p<0.001

TABLE 4.32: Correlation of 'Asbestos Handling' and Safety Performance

Asbestos Handling	Safety Performance		
Rows : C149	Columns : C301		
	1	2	ALL
1	28	45	73
2	2	7	9
3	19	25	44
AL	49	77	126

Chi-square 1.40; df = 2, not significant.

TABLE 4.33: Correlation of 'Asbestoc Information' and Safety Performance = 0.601

Asbestos Information	Safety Performance		
Rows : C150	Columns : C301		
	1	2	ALL
1	9	4	13
2	39	18	57
3	1	55	56
ALL	49	77	126

TABLE 4.34: Correlation of 'Plant/Equipment Training before use and Safty Performance = 0.236

Plant Training & use	Safety Performance		
Rows : C151	Columns : C301		
	1	2	ALL
1	45	71	116
2	1	1	2
3	3	5	8
ALL	49	77	126

Chi-Square = 0.11; df = 2, not significant

TABLE 4.35: Correlation of 'Scaffolding and Ladder Usage' and Safety Performance = 0.744

Scaffolding & Ladder Usage	Safety Performance		
Rows : C152	Columns : C301		
	1	2	ALL
1	45	1	46
2	4	71	75
3	0	5	5
ALL	49	77	126

Chi-square = 105.95; df = 2, significant at p=0.005

TABLE 4.36: **Correlation of 'Adequate Scaffolding Inspection' and Safety Performance = 0.696**

Scaffolding Inspection	Safety Performance		
Rows : C153	Columns : C301		
	1	2	ALL
1	9	0	9
2	40	17	57
3	0	60	60
ALL	49	77	126

Ch-square = 75.80; df = 2, significant at p=0.001

NOTE: 1 cells with expected counts less than 5.0

TABLE 4.37: **Correlation of 'Commonsense and Building Experience in Scaffolding Erection' and Safety Performance = 0.699**

Building Experience and Commonseanse in Scaffolding	Safety Performance		
Rows : C154	Columns : C301		
	1	*2*	*ALL*
1	6	1	7
2	43	15	58
3	0	61	61
ALL	49	77	126

Chi-square = 75.60; df = 2, significant at p<0.001

TABLE 4.38: **Correlation of 'Steel Erector Training Skills' and Safety Performance = 0.662**

Steel Erector Training	Safety Performance		
Rows : C155	Columns : C301		
	1	2	ALL
1	11	0	11
2	37	18	55
3	1	59	60
ALL	49	77	126

Chi-square = 70.91; df = 2, significant at p<0.01

TABLE 4.39: Correlation of 'Reliance on Commonsense only for dumper driving' and Safety Performance = 0.000

Commonsense and Dumper driving (without training)	Safety Performance		
Rows : C156	Columns : C301		
	1	2	ALL
1	13	26	39
2	0	6	6
3	36	45	81
ALL	49	77	126

Chi-square = 5.38; df = 2, not significant

TABLE 4.40: Correlation of 'trained Plant Driver' and Safety Performance = 0.684

Plant Driver Rraining	Safety Performance		
Rows : C157	Columns : C301		
	1	2	ALL
1	39	0	39
2	10	67	77
3	0	10	10
ALL	49	77	126

Chi-square = 89.39; df=2, significant at p<0.01

PROCEDURAL FACTORS - C7 = C10

TABLE 4.41: Correlation of 'Provision of Protective Safety Clothes etc' and Safety Performance = 0.310

Provision of Safety 'gadgets' Etc	Safety Performance		
Rows : C140	Columns : C301		
	1	2	ALL
1	37	7	44
2	11	62	73
3	1	8	9
ALL	49	77	126

Chi-square = 58.18; df = 2, p=0.001

NOTE: 1 cells with expected counts less than 5.00

TABLE 4.42: Corelation of 'Workers' non-use of Protective Safety Clothing etc/sanctions' and Safety Performance = 0.113

Protective Clothing etc Non-use	Safety Performance		
Rows : C141	Columns : C301		
	1	2	ALL
1	33	53	86
2	5	12	17
3	11	12	23
ALL	49	77	126

Chi-square = 1.43; df = 2, not significant

TABLE 4.43: Correlation of 'Issuing Protective Equipment etc' and Safety Performance = 0.628

Usage of Protective Clothing etc	Safety Performance		
Rows : C142	Columns : C301		
	1	2	ALL
1	41	3	44
2	6	64	70
ALL	49	77	126

Chi-square = 1.98; df = 2, not significant.

TABLE 4.44: **Correlation of 'Familiarity with Safety Equipment and Clothing etc through training' and Safety Performance = 0.070**

Safety Clothing etc - training	Safety Performance		
Rows : C143	Columns : C301		
	1	2	ALL
1	46	69	115
2	0	3	3
3	3	5	8
ALL	49	77	126

Chi-square = 1.98; df = 2, not significant

TABLE 4.45: **Correlation of 'Safety Procedure Booklet without worker induction' and Safety Performance = 0.049**

Safety Booklet without induction	Safety Procedure		
Rows : C144	Columns : C301		
	1	2	ALL
1	32	5	37
2	11	61	72
3	6	11	17
ALL	49	77	126

Chi-square = 52.25; df = 2, not significant.

TABLE 4.46: **Correlation of 'Safety Booklet with induction on first day' and Safety Performance = 0.718**

Safety Booklet with Induction	Safety Performance		
Rows : C145	Columns : C301		
	1	2	ALL
1	43	1	44
2	6	73	79
3	0	3	3
ALL	49	77	126

Chi-square = 98.56; df = 2, significant at p=0.001

TABLE 4.47: Correlation of 'Safety Induction without Safety Manuals on first day' and Safety Performance = -0.031

Safety Induction without safety Manuals	Safety Performance		
Rows : C146	Columns : C301		
	1	2	ALL
1	42	67	109
2	5	7	12
3	2	3	5
ALL	49	77	126

Chi-square = 0.05; df = 2, not significant.

ORGANISATION FACTORS - C8 = C10

TABLE 4.48: Correlation of 'worker-management Relationships' and Safety Performance = 0.754

Worker-management Relationships	Safety Performance		
Rows : C158	Columns : C301		
	1	2	ALL
1	44	0	44
2	5	69	74
3	0	8	8
ALL	49	77	126

Chi-square = 106.38; df = 2, significant at p<0.001

ABLE 4.49: Correlation of 'Trade Union Involvement with Safety' and Safty Performance = 0.153

Trade Union Safety Involvement	Safety Performance		
Rows : C159	*Columns : C301*		
	1	2	ALL
1	23	19	42
2	22	52	74
3	4	6	10
ALL	49	77	126

Chi-square = 7.07; df = 2, not significant

\BLE 4.50: Correlation of 'Sub-Contractor Safety Behaviour' and Safety Performance = 0.593

Sub-contractor Site Safety Behaviour	Safety Performance		
Rows : C160	Columns : C301		
	1	2	ALL
1	22	3	36
2	16	60	76
3	0	14	14
ALL	49	67	126

Chi-square = 61.28; df = 2, significant at p<0.02

)RGANISATION FACTORS - C8 = C10

IBLE 4.48: Correlation of 'worker-management Relationships' and Safety Performance = 0.754

Worker-management Relationships	Safety Performance		
Rows : C158	Columns : C301		
	1	2	ALL
1	44	0	44
2	5	69	74
3	0	8	8
ALL	49	77	126

Chi-square = 106.38; df = 2, significant at p<0.001

LE 4.49: Correlation of 'Trade Union Involvement with Safety' and Safty Performance = 0.153

Trade Union Safety Involvement	Safety Performance		
Rows : C159	Columns : C301		
	1	2	ALL
1	23	19	42
2	22	52	74
3	4	6	10
ALL	49	77	126

Chi-square = 7.07; df = 2, not significant

.E 4.50: Correlation of 'Sub-Contractor Safety Behaviour' and Safety Performance = 0.593

Sub-contractor Site Safety Behaviour	Safety Performance		
Rows : C160	Columns : C301		
	1	2	ALL
1	22	3	36
2	16	60	76
3	0	14	14
ALL	49	67	126

Chi-square = 61.28; df = 2, significant at p<0.02

TABLE 4.51: Correlation of 'Having Safety Representaive on Site' and Safety Performance = 0.497

Safety Representative	Safety Performance		
Rows : C161	Columns : C301		
	1	2	ALL
1	32	11	43
2	16	64	80
3	1	2	3
ALL	49	77	126

Chi-square = 34.89; df = 2, p<0.01

TABLE 4.52: Correlation of 'Management -workers' Co-operation' and Safety Performance = 0.541

Management-Workers' Co-operation	Safety Performance		
Rows : C162	Columns : C301		
	1	2	ALL
1	36	9	45
2	13	64	77
3	0	4	4
ALL	49	77	126

Chi-square = 58.24; df = 2, p=0.001

TABLE 4.53: Correlation of 'Safety Committe Input/Role to Site Safety' and Safety Performance = 0.475

Safety Committee Input	Safety Performance		
Rows : C163	Columns : C301		
	1	2	ALL
1	32	15	47
2	16	58	74
3	1	4	5
ALL	49	77	126

Chi-Square = 26.89; df = 2, p=0.005

BLE 4.54: Correlation of 'Workers' Belief in Company Safety Efforts' and Safety Performance = 0.084

Belief in Company Safety Effort	Safety Performance		
Rows : C164	Columns : C301		
	1	2	ALL
1	38	41	79
2	1	17	18
3	10	19	29
ALL	49	77	126

Chi-square = 11.47; df = 2, not significant

LE 4.55: Correlation of 'Safety Talks by Managers and Supervisors to operatives' and Safety Performance = 0.357

Regular Safety Talks by Managers & Supervisors	Safety Performance		
Rows : C165	Columns : C301		
	1	2	ALL
1	18	12	30
2	26	43	69
3	5	22	27
ALL	49	77	126

Chi-square = 10.38; df = 2; p=0.01

LE 4.56: Correlation of 'Use of Safety Posters on Site' and Safety Performance = 0.287

Safety Posters	Safety Performance		
Rows : C166	Columns : C301		
	1	2	ALL
1	23	20	43
2	26	49	75
3	0	8	8
ALL	49	77	126

Chi-square = 29.77; df = 4, p<0.005

'IRONMENTAL/EXTERNAL FACTORS - C9 = C10

BLE 4.57: Correlation of 'Clean and Tidy Sites' and Safety Performance = 0.794

Clean and Tidy Sites	Safety Performance		
Rows : C167	Columns : C301		
	1	2	ALL
1	49	7	56
2	0	67	67
3	0	3	3
ALL	49	77	126

Chi-square = 100.2; df = 2, significant at $p<0.01$

3LE 4.58: Correlation of 'Job Skills and Knowledge', and Safety Performance = 0.884

Job skills and job knowledge	Safety Performance		
Rows : C168	Columns : C301		
	1	2	ALL
1	48	1	49
2	1	69	70
3	0	7	7
AL	49	77	126

Chi-square = 117.73; df = 2, significant at $p<0.001$

ILE 4.59: Correlation of 'Untidy Sites' and Safety Performance = 0.417

Untidy sites	Safety Performance		
Rows : C169	Columns : C301		
	1	2	ALL
1	13	3	16
2	30	26	56
3	6	48	54
ALL	49	77	126

Chi-square = 34.69; df = 2, $p<0.01$

ABLE 4.60: Correlation of 'Workers' Co-operation with each other 'on site' and Safety Performance = 0.753

Workers' on-site Co-operation with each other	Safety Performance		
Rows : C170	Columns : C301		
	1	2	ALL
1	42	0	42
2	7	69	76
3	0	8	8
ALL	49	77	126

Chi-square = 99.26; df = 2, significant at p<0.001

BLE 4.61: Correlation of 'Company Instructions on Application of Harmful Substances and Safety Performance = 0.055

Instructions on Harmful Substance Usage	Safety Performance		
Rows : C171	Columns : C301		
	1	2	ALL
1	23	33	56
2	9	16	25
3	17	28	45
ALL	49	77	126

Chi-Square = 0.22; df = 2, not significant

LE 4.62: Correlation of 'Manager/Supervisor Safety Examples to Workers and Safety Performance

Manager-Supervisor Safety Behaviour	Safety Performance		
Rows ; C172	Columns : C301		
	1	2	ALL
1	34	0	34
2	15	65	80
3	0	12	12
ALL	49	77	126

.E 4.63: **Correlation of 'Planned and Organised sites' and Safety Performance = 0.418**

Planned and Organised Sites	Safety Performance		
Rows : C173	Columns : C301		
	1	2	ALL
1	13	3	16
2	30	26	56
3	6	48	54
ALL	49	77	126

Chi-square = 34.75; df = 2, p=0.001

LE 4.64: **Correlation of 'Worker Carefulness and Observance on Site' and Safety Performance = 0.340**

Worker Carefulnes And Onservance	Safety Performance		
Rows : C174	Columns : C301		
	1	2	ALL
1	31	15	46
2	17	58	75
3	1	4	5
ALL	49	77	126

APPENDIX : L:

ATTITUDINAL/BEHAVIOURAL TEST OF SIGNIFICANCE TABLES - COMPARISON OF OPERATIVES' AND SITE MANAGERS ATTITUDES

ATTITUDINAL & BEHAVIOURAL : TEST OF SIGNIFICANCE

OPERATIVES AND SITE MANAGERS : ECONOMIC FACTORS

(a) **TABLE NO:**
Bonus systems lead to reduced concern for safety on site.
~~C 14 = C 18~~

	(1) S A	(2) Others	(3) Sample Size
OP-C 14	51	75	126
SM-C 18	39	35	74

x^2 = 2.82;p< not significant
df = 1 . not significant

(b) TABLE NO : Need to meet commercial profits influences safety organisation.
C 19 = C 22

	(1) S A	(2) Others	(3) Sample Size
OP-C 19	124	2	126
SM-C 22	35	39	74

x^2 = 64.60; p<0.001
df = 1 1. . Very significant

(c) TABLE NO : Bonus systems leas supervisors to turn 'blind eye' to safety hazards.
C 15 = C 26

	(1) S A	(2) Others	(3) Sample Size
OP-C 15	97	29	126
SM-C 26	21	53	74

x^2 = 45.53; p<0.001
df = 1 Very significant

(d) TABLE NO : More training leads to safety improvement.
C 13 = C 21

	(1) S A	(2) Others	(3) Sample Size
OP-C 13	49	77	126
SM-C 21	54	20	74

x^2 = 21.68;p<.001
df = 1 . very significant

(e) TABLE NO : Safety bonus improves safety performance
C 16 = C 27

	(1) S A	(2) Others	(3) Sample Size
OP-C 16	27	99	126
SM-C 27	42	32	74

x^2 = 25.75; p<0.05
df = 1 . . Very *significant*

(f) TABLE NO : Productivity improves safety performance
C 18 = C 26

	(1) S A	(2) Others	(3) Sample Size
OP-C 18	103	23	126
SM-C 26	39	35	74

x^2 = 19.10; p <.001
df = 1 Very significant

NOTES: - x^2 = Chi Square

SA = strongly agree
Oth = Others - disagree etc
SS = Sample size
OP = Operatives
SM = Site Managers

PSYCHOLOGICAL FACTORS

(a) **TABLE NO:**
Increased safety awareness influences safety peforamnce.
C22 = C28

	(1) S A	(2) Others	(3) Sample Size
OP-C22	125	1	126
SM-C28	71	3	74

x^2 = 2.53; p<0.10
df = 1 not significant

(b) **TABLE NO**
Workers' behaviour on site influences safety performance
C 29 = C29

	(1) S A	(2) Others	(3) Sample Size
OP-C 29	86	40	126
SM-C 29	66	8	74

x^2 = 11.20; p<0.01
df = 1 . significant

(c) **TABLE NO**
Workers' perception of building work as tough and dangerous, influences macho behaviour/risk taking.
C 26 = C 30

	(1) S A	(2) Others	(3) Sample Size
OP-C 26	117	9	126
SM-C 30	17	57	74

x^2 = 102.98; p<0.001
df = 1 1 Highly significant

(d) TABLE NO
Safety training and updating increased safety awareness
C 25 = C 31

	(1) S A	(2) Others	(3) Sample Size
OP-C25	118	8	126
SM-C31	61	13	74

x^2 = 6.24; p<0.01
df = 1 Significant

(e) **TABLE NO**
Safety is mostly a matter of common-sense
C29 = C32

	(1) S A	(2) Others	(3) Sample Size
OP-C29	86	40	126
SM-C32	44	30	74

x^2 = 1.58; p< not significant
df = 1 not significant

(f) **TABLE NO**
Site managers' safety attitudes influences workers' safety attitudes.
C 28 = C 36

	(1) S A	(2) Others	(3) Sample Size
OP-C 28	114	12	126
SM-C 36	71	3	74

x^2 = 2.01;
df = 1 Not significant

NOTES: - x^2 = Chi Square

SA = strongly agree
Oth = Others - disagree etc
SS = Sample size
OP = Operatives
SM = Site Managers

PROCEDURAL FACTORS

(a) TABLE NO:
Provision of safety protective clothing/equipment leads to safety awareness
$C_{39} = C_{41}$

	(1) S A	(2) Others	(3) Sample Size
OP-C 39	119	7	126
SM-C 41	60	14	74

x^2 = 8.86; $p<0.02$
df = 1 significant

(b) TABLE NO
Workers who fail to use protective clothing etc, be sanctioned to improve safety discipline on site
$C_{40} = C_{42}$

	(1) S A	(2) Others	(3) Sample Size
OP-C 40	115	11	126
SM-C 42	61	13	74

x^2 = 3.45; $p<0.05$
df = 1 Significant

(c) TABLE NO
Providing new workers with safety manuals, followed by Induction, improves safety on site
C 44 = C 45

	(1) S A	(2) Others	(3) Sample Size
OP-C44			126
SM-C45			74

x^2 = 7.34; $p<0.025$
df = 1 Significant

(d) TABLE NO
Belief in receiving safety instructions on joining a new firm improves safety awareness
$C_{43} = C_{46}$

	(1) S A	(2) Others	(3) Sample Size
OP-C43	109	17	126
SM-C46	54	20	74

x^2 = 5.66; $p<0.02$
df = 1 significant

TECHNICAL FACTORS

(a) **TABLE NO:**
Knowledge of safety hazards on site influences safety performance
$C_{56} = C_{47}$

	(1) S A	(2) Others	(3) Sample Size
OP-C 56	72	54	126
SM-C 47	66	8	74

x^2 = 22.38; p<0.05
df = 1 Very significant

(b) **TABLE NO**
Workers' ability to spot safety hazards on site, leads to accident prevention
$C_{51} = C_{48}$

	(1) S A	(2) Others	(3) Sample Size
OP-C 51	15	111	126
SM-C 48	40	34	74

x^2 = 41.54; p<
df = 1 Very significant

(c) **TABLE NO**
Commonsense and building experience enough for dumper (plant(driving and scaffolding erection
$C_{53} = C_{49}$

	(1) S A	(2) Others	(3) Sample Size
OP-C 53	39	87	126
SM-C 49	68	6	74

x^2 = 69.59; p<
df = 1 Highly significant

(d) **TABLE NO**
Hazard Identification equals less Accidents on site
$C_{55} = C_{50}$

	(1) S A	(2) Others	(3) Sample Size
OP-C55	98	28	126
SM-C50	34	40	74

x^2 = 21.05; p<
df = 1 Very significant

ORGANISATIONAL FACTORS

(a) **TABLE NO:**
Worker-management relationships on site influences safety performance
C57 = C57

	(1) S A	(2) Others	(3) Sample Size
OP-C 57	90	36	126
SM-C 57	34	40	74

x^2 = 12.85; p<
df = 1 Very significant

(b) **TABLE NO**
Trade Union involvement in safety Reduces accidents on site
C58 = C58

	(1) S A	(2) Others	(3) Sample Size
OP-C 58	93	33	126
SM-C 58	33	41	74

x^2 = 17.07; p<
df = 1 Very significant

(c) **TABLE NO**
Workers' safe working and management co-operation improves safety on site
C61 = C59

	(1) S A	(2) Others	(3) Sample Size
OP-C61	96	30	126
SM-C59	30	44	74

x^2 = 25.42; p<
df = 1 . Very significant

(d) TABLE NO
Having safety committees improves Safety standards
C62 = C61

	(1) S A	(2) Others	(3) Sample Size
OP-C62	79	47	126
SM-C	69	5	74

x^2 = 22.61; p<
df = 1 Very significant

(e) TABLE NO
Managers and supervisors do not talk enough about safety to workers
C64 = C62

	(1) S A	(2) Others	(3) Sample Size
OP-C64	102	24	126
SM-C62	50	24	74

x^2 = 4.58; p<
df = 1 Significant

(f) TABLE NO
Management Safety attitudes determine workers' safety behaviour on site
C63 = C63

	(1) S A	(2) Others	(3) Sample Size
OP-C63	61	65	126
SM-C63	58	16	74

x^2 = 17.37; p<
df = 1 Significant

NOTES: - x^2 = Chi Square

SA = strongly agree
Oth = Others - disagree etc
SS = Sample size
OP = Operatives
SM = Site Managers

ENVIRONMENTAL/EXTERNAL FACTORS

(a) **TABLE NO:**
Untidy building sites leads to accidents

C 83 = C 68

	(1) S A	(2) Others	(3) Sample Size
OP-C83	83	43	126
SM-C68	68	6	74

x^2 = 17.06; p<
df = 1 Very significant

(b) **TABLE NO**
Good job Planning, and site organisation lead to low accidents
C87 = C71

	(1) S A	(2) Others	(3) Sample Size
OP-C 87	42	84	126
SM-C 71	63	11	77

x^2 = 50.17; p<
df = 1 Highly significant

(c) **TABLE NO**
Workers who know their jobs are thoughtful of the way they work, & have less accidents
C 82 = C 76

	(1) S A	(2) Others	(3) Sample Size
OP-C 82	58	68	126
SM-C 76	69	5	74

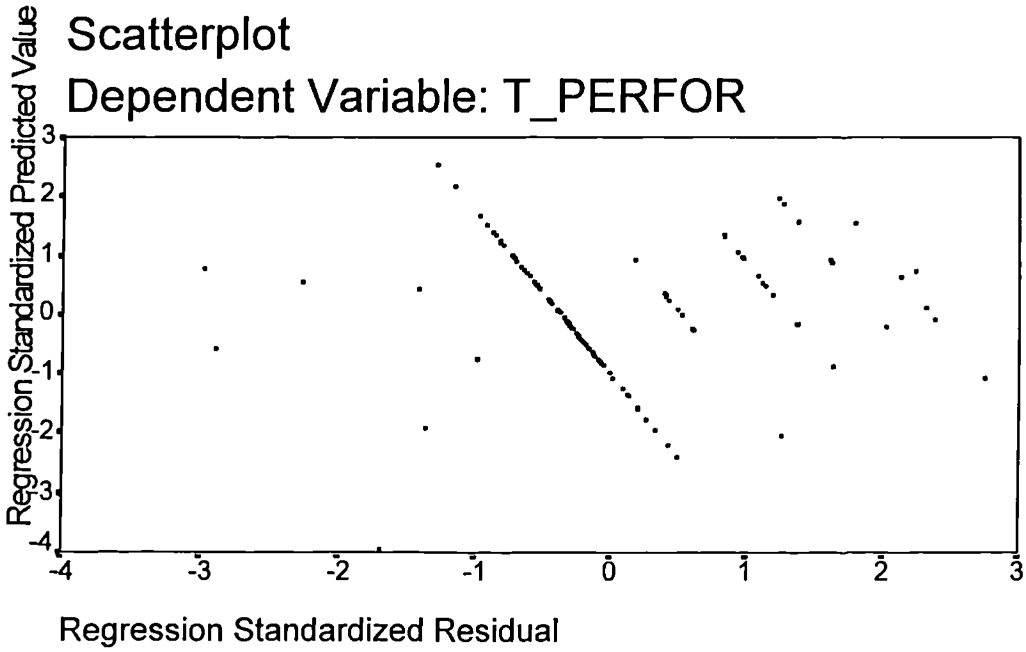
x^2 = 44.83; p<
df = 1 Highly significant

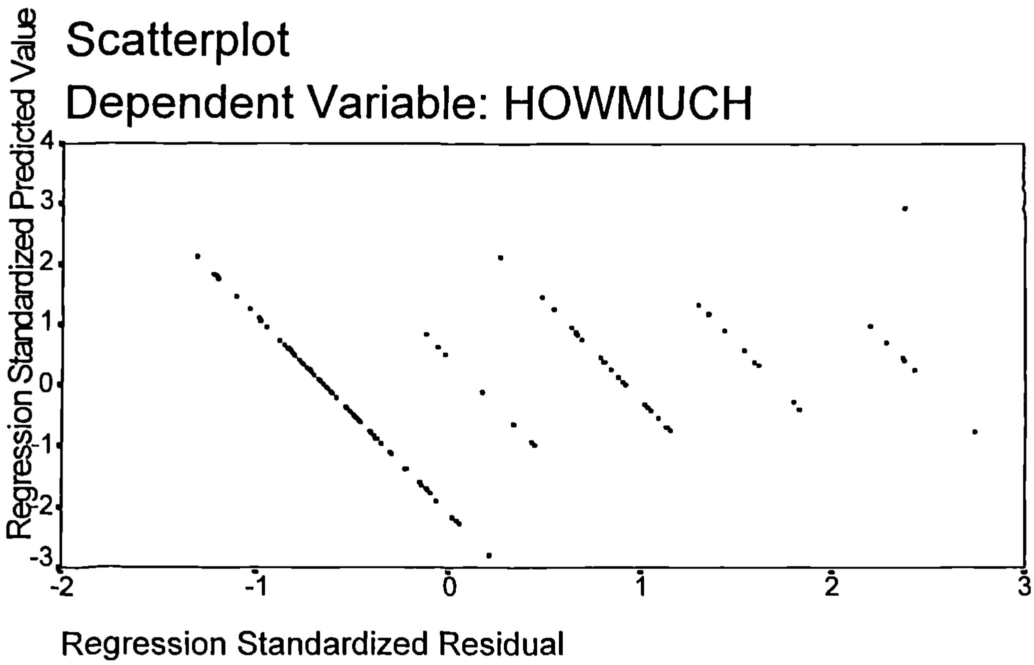
Variable	Skewness	p-value	Kurtosis	p-value
age	0.4878	0.0254	-0.6746	0.0020
asbesite	0.3624	0.0968	-0.6259	0.0041
asbestos	2.5749	0.0000	9.2013	0.0000
avoid	0.9402	0.0000	2.3290	0.0000
banksman	0.0185	0.9325	-0.6333	0.0037
believe	1.0793	0.0000	2.1882	0.0000
blindeye	-0.1769	0.4175	-1.2262	0.0000
bonus	-0.0364	0.8675	-1.1772	0.0000
careful	1.0900	0.0000	1.4014	0.0000
cares	0.0125	0.9542	-1.1681	0.0000
cause	-0.7446	0.0006	-0.4815	0.0274
commitee	0.8030	0.0002	1.2635	0.0000
cooperat	1.3056	0.0000	2.3014	0.0000
dumper	-0.5659	0.0095	-0.8983	0.0000
enough	0.7125	0.0011	-0.3494	0.1094
equip	1.4062	0.0000	3.3871	0.0000
erector	-1.0276	0.0000	0.1702	0.4354
examples	0.5721	0.0088	-0.6761	0.0019
handle	0.2938	0.1782	-1.1989	0.0000
helmet	1.7690	0.0000	3.4182	0.0000
howmuch	1.3302	0.0000	0.6875	0.0016
industry	0.4610	0.0347	-0.6357	0.0036
involve	0.4336	0.0469	-0.3700	0.0900
jobs	1.4163	0.0000	2.0691	0.0000
lessacci	1.1370	0.0000	1.3096	0.0000
like	4.0683	0.0000	24.7383	0.0000
mechan	1.6932	0.0000	4.2162	0.0000
money	0.4115	0.0593	-0.9281	0.0000
operate	0.8848	0.0001	0.0572	0.7931
perform	2.7275	0.0000	8.8537	0.0000
plan	1.2947	0.0000	3.6342	0.0000
posters	0.8909	0.0000	0.4766	0.0290
product	1.1380	0.0000	1.4593	0.0000
proper	-1.1734	0.0000	0.9786	0.0000
protect	1.3943	0.0000	4.8814	0.0000
reduce	0.3636	0.0956	-1.1075	0.0000
relation	0.9723	0.0000	0.8118	0.0002
risks	0.9063	0.0000	-0.1762	0.4194
risky	0.0491	0.8219	-1.4682	0.0000
safeact	0.5644	0.0097	-0.2318	0.2881
safebook	1.4840	0.0000	4.2574	0.0000
safeinsp	-1.2161	0.0000	-0.1191	0.5852
saferep	0.7070	0.0012	0.5111	0.0192
safety	2.2707	0.0000	6.0998	0.0000
scaffold	1.7410	0.0000	4.3573	0.0000
sense	-1.3623	0.0000	1.4988	0.0000
service	1.2389	0.0000	1.5544	0.0000
site	-0.8036	0.0002	-0.1916	0.3798
skillful	0.6050	0.0056	-0.4742	0.0298
subcont	0.7957	0.0003	-0.3882	0.0753
superv	-0.0034	0.9876	-1.3945	0.0000
talk	1.2668	0.0000	2.4894	0.0000
tell	-1.0638	0.0000	0.7312	0.0008
tidysite	1.0870	0.0000	3.4518	0.0000
toxic	0.0290	0.8942	-1.1001	0.0000
training	0.9788	0.0000	2.2936	0.0000
wear	0.8032	0.0002	0.0099	0.9638
workmata	-1.1005	0.0000	0.3086	0.1573

Final Statistics

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
AGE	.88155	*	1	7.47630	13.4	13.4
ASBESITE	.73907	*	2	3.36423	6.0	19.4
AVOID	.61941	*	3	2.93368	5.2	24.6
BANKSMAN	.70771	*	4	2.71302	4.8	29.4
BELIEVE	.71708	*	5	2.43282	4.3	33.8
BLINDEYE	.75258	*	6	2.12314	3.8	37.6
BONUS	.72182	*	7	2.09807	3.7	41.3
CAREFUL	.73571	*	8	1.86113	3.3	44.6
CARES	.74799	*	9	1.79600	3.2	47.9
CAUSE	.74099	*	10	1.74164	3.1	51.0
COMMITEE	.68721	*	11	1.63690	2.9	53.9
COOPERAT	.77580	*	12	1.54180	2.8	56.6
DUMPER	.65542	*	13	1.38063	2.5	59.1
ENOUGH	.64286	*	14	1.30806	2.3	61.4
EQUIP	.79703	*	15	1.25756	2.2	63.7
ERECTOR	.69321	*	16	1.24149	2.2	65.9
EXAMPLES	.63998	*	17	1.11895	2.0	67.9
HANDLE	.72319	*	18	1.10026	2.0	69.9
HELMET	.69509	*	19	1.03733	1.9	71.7
INDUSTRY	.87078	*				
INVOLVE	.77305	*				
JOBS	.68219	*				
LESSACCI	.75060	*				
MECHAN	.76018	*				
MONEY	.77568	*				
OPERATE	.75213	*				
PLAN	.76583	*				
POSTERS	.70405	*				
PRODUCT	.69169	*				
PROPER	.77524	*				
PROTECT	.78043	*				
REDUCE	.61624	*				
RELATION	.69906	*				
RISKS	.69219	*				
RISKY	.65226	*				
SAFEACT	.65904	*				
SAFEBOOK	.79806	*				
SAFEINSP	.70772	*				
SAFEREP	.71845	*				
SCAFFOLD	.73946	*				
SENSE	.68310	*				
SERVICE	.70342	*				
SITE	.71480	*				
SKILLFUL	.80856	*				
SUBCONT	.69406	*				
SUPERV	.61490	*				
T_ASBEST	.57548	*				
T_LIKE	.76791	*				
T_SAFETY	.63938	*				
TALK	.86435	*				
TELL	.54741	*				
TIDYSITE	.66787	*				
TOXIC	.72536	*				
TRAINING	.78027	*				
WEAR	.66006	*				
WORKMATA	.67805	*				

Residual Plots





DATA	MAHALANOBIS DISTANCE	COOK'S DISTANCE	LEVERAGE
1	13.74600	.00019	.10997
2	6.11365	.00127	.04891
3	15.56630	.02734	.12453
4	5.11484	.00528	.04092
5	22.29945	.00040	.17840
6	7.57266	.00132	.06058
7	13.83750	.00307	.11070
8	20.40999	.00001	.16328
9	20.84809	.00086	.16678
10	22.06737	.00017	.17654
11	10.05248	.00097	.08042
12	12.30928	.00045	.09847
13	15.50026	.00090	.12400
14	28.04247	.00025	.22434
15	7.80477	.00452	.06244
16	6.33330	.00291	.05067
17	6.24658	.00088	.04997
18	8.51992	.00028	.06816
19	3.63179	.00051	.02905
20	10.07652	.01676	.08061
21	8.48917	.00087	.06791
22	7.33103	.03200	.05865
23	9.34663	.00050	.07477
24	8.09889	.01891	.06479
25	9.07673	.01228	.07261
26	7.79246	.00044	.06234
27	14.75770	.02636	.11806
28	13.37462	.00020	.10700
29	7.77407	.00041	.06219
30	4.93143	.00125	.03945
31	4.50882	.01658	.03607
32	6.44290	.00381	.05154
33	11.73762	.03419	.09390
34	11.08689	.01311	.08870
35	14.80867	.01057	.11847
36	12.78239	.00028	.10226
37	10.58281	.00145	.08466
38	5.15993	.04021	.04128
39	14.11946	.00103	.11296
40	8.43710	.00708	.06750
41	4.90907	.00406	.03927
42	6.04991	.00007	.04840
43	6.59971	.00003	.05280
44	9.13894	.00057	.07311
45	6.77820	.00059	.05423
46	7.12982	.00200	.05704
47	9.10094	.04553	.07281
48	20.55889	.00430	.16447
49	4.87353	.00179	.03899
50	11.28246	.00093	.09026
51	11.12715	.01888	.08902
52	14.91791	.01824	.11934
53	10.77009	.00009	.08616
54	14.88160	.00069	.11905
55	8.77543	.00207	.07020
56	5.81607	.00188	.04653
57	7.59568	.00291	.06077
58	4.75387	.00060	.03803
59	11.12810	.00019	.08902
60	4.25911	.00117	.03407
61	38.21413	.00179	.30571
62	27.42147	.08999	.21937
63	14.77841	.00113	.11823
64	7.32801	.00018	.05862
65	9.07275	.00070	.07258
66	3.80103	.00035	.03041
67	25.58835	.01102	.20471
68	5.88802	.00083	.04710
69	9.25581	.00012	.07405
70	25.70815	.00120	.20567
71	19.37552	.00011	.15500
72	16.23552	.00280	.12988
73	5.12980	.00072	.04104
74	10.46793	.00193	.08374
75	28.57172	.17229	.22857
76	3.66906	.00893	.02935
77	8.83564	.00284	.07069
78	9.52162	.01355	.07617
79	6.38849	.01112	.05111
80	5.65237	.00625	.04522
81	11.32395	.02638	.09059
82	9.10080	.00756	.07281
83	3.13618	.00205	.02509
84	5.91761	.00439	.04734
85	11.11288	.00016	.08890
86	6.81256	.00213	.05450
87	11.28590	.00638	.09029
88	4.82867	.03241	.03863
89	15.14684	.00395	.12117
90	37.59804	.00017	.30078
91	16.78579	.00031	.13429
92	21.27507	.00119	.17020
93	15.72348	.00122	.12579
94	8.20965	.00215	.06568
95	11.99844	.01027	.09599
96	3.58216	.00019	.02866
97	11.44870	.00048	.09159
98	10.92551	.00498	.08740
99	5.44638	.00026	.04357
100	10.61051	.00005	.08488
101	9.47162	.00028	.07577
102	12.07449	.00227	.09660
103	14.74747	.02271	.11798
104	12.54420	.00220	.10035
105	11.30841	.01603	.09047
106	8.26617	.00632	.06613
107	13.20594	.00128	.10565
108	7.12729	.00062	.05702
109	14.15077	.00199	.11321
110	9.53633	.00066	.07629
111	4.22801	.00080	.03382
112	15.52589	.01025	.12421
113	12.05654	.00102	.09645
114	11.15540	.00109	.08924
115	9.43871	.06890	.07551
116	7.18852	.00457	.05751
117	5.01731	.00234	.04014
118	5.09974	.02043	.04080
119	6.18189	.00260	.04946
120	6.71358	.03137	.05371
121	7.47164	.00120	.05977
122	9.07188	.00000	.07258
123	4.22015	.00037	.03376
124	7.62699	.00106	.06102
125	5.71663	.00209	.04573
126	5.50246	.00692	.04402

APPENDIX : M:

ATTITUDINAL /BEHAVIOURAL TEST OF SIGNIFICANCE TABLES - COMPARISON OF SITE MANAGERS, CONTRACT MANAGERS AND SAFETY ADVISERS (ETC), ATTITUDES

NOTE: Key:

S M = Site management
C M = Contract Management
S A = Safety Advisers/Managers etc
N S = Not significant
S = Significant
V S = Very significant

ATTITUDINAL/BEHAVIOURAL TEST OF SIGNIFICANCE : SITE MANAGER VERSUS CONTRACT MANAGER AND SAFETY ADVISERS/MANAGERS : ECONOMIC FACTORS

1. Bonus systems influence safety organisation on site

	A	B	C
S M = C18–C100	39	35	74
C M = C23–C100	31	25	56
S A = C18–C100	42	13	55

X^2 = 0.09 df = 1; p = N S
X^2 = 5.44 df = 1; p = S
X^2 = 8.30 df = 1; p = S

2. More safety training equals better safety standards.

C 21 = C 26 = C 21

	A	B	C
S M = C 21	54	20	74
C M = C 26	35	21	56
S A = C 21	47	8	55

X^2 = 1.62 df = 1; p = N S
X^2 = 7.58 df = 1; p = S
X^2 = 7.53 df = 1; p = S

2. Injury-related accidents lead to productivity loss.

C12 = C24 = C19

	A	B	C
S M = C19	67	7	74
C M = C23	49	7	56
S A = C19	53	2	55

X^2 = 0.31 df = 1; p = N S
X^2 = 2.93 df = 1; p = N S
X^2 = 2.86 df = 1; p = N S

5. Need to achieve commercial Advantage in tenders influences site safety organisation.

C 22 = C 27 = C 22

	A	B	C
S M = C 22	34	40	74
C M = C 27	34	22	56
S A = C 22	44	11	55

X^2 = 2.79 df = 1; p = N S
X^2 = 4.94 df = 1; p = S
X^2 =15.32 df = 1; p = V S

3. Bonus systems lead supervisors to turn a 'blind eye' to safety hazards on site.

C 20 = C25 = C20

	A	B	C
S M = C 20	21	53	74
C M = C 25	20	36	56
S A = C 20	36	19	55

X^2 = 0.79 df = 1; p = N S
X^2 = 9.82 df = 1; p = S
X^2 =19.00 df = 1; p = V S

6. A per centage safety job-cost allowed in every tender will improve safety on site.

C 23 = C 28 = C 23

	A	B	C
S M = C 23	58	16	74
C M = C 28	39	17	56
S A = C 23	48	7	55

X^2 = 1.28 df = 1; p = N S
X^2 = 5.09 df = 1; p = S
X^2 = 5.09 df = 1; p = S

7. Client contribution to enforce safety input at tenders improves safety organisation on site.
C 24 = C 29 = C 24

	A	B	C
S M = C 24	59	15	74
C M = C 29	41	15	56
S A = C 24	49	6	55

X^2 = 0.76 df = 1; p = NS
X^2 = 4.45 df = 1; p = S
X^2 = 4.51 df = 1; p = S

8. Contractor compliance with contract safety provisions promote better safety performance on site.

C 25 = C 30 = C 25

	A	B	C
S M = C 25	67	7	74
C M = C 30	40	16	56
S A = C 25	51	4	55

X^2 = 8.00 df = 1; p = S
X^2 = 8.25 df = 1; p = S
X^2 = 12.71 df = 1; p = VS

9. Workers' safety consciousness on site influences productivity targets.

C 26 = C 31 = C 26

	A	B	C
S M = C 26	39	35	74
C M = C 31	32	24	56
S A = C 26	35	20	55

X^2 = 0.25 df = 1; p = NS
X^2 = 0.49 df = 1; p = NS
X^2 = 1.54 df = 1; p = NS

10. Awarding safety bonuses leads to improved safety performance.

C27 = C32 = C27

	A	B	C
S M = C27	42	32	74
C M = C32	25	31	56
S A = C27	29	26	55

X^2 = 1.87 df = 1; p = NS
X^2 = 0.73 df = 1; p = NS
X^2 = 1.90 df = 1; p = NS

PSYCHOLOGICAL FACTORS

11. Individual safety awareness improves safety performance

C28 = C33 = C 28

	A	B	C
S M = C28	71	3	74
C M = C33	51	5	56
S A = C28	50	5	55

X^2 = 1.31 df = 1; p = NS
X^2 = 0.00 df = 1; p = NS
X^2 = 1.67 df = 2; p = NS

12. Workers' irresponsible site behaviour undermines safety performance.

C29 = C34 = C29

	A	B	C
S M = C29	66	8	74
C M = C34	50	6	56
S A = C29	51	4	55

X^2 = 0.00 df = 1; p = NS
X^2 = 0.40 df = 1; p = NS
X^2 = 0.54 df = 2; p = NS

13. Workers' perception of building work as tough and dangerous influences macho behaviour and risk-taking.

C30 = C 35= C 30

	A	B	C
S M = C 30	17	57	74
C M = C 35	16	40	56
S A = C 30	9	46	55

X^2 = 5.32 df = 1; p = S
X^2 = 2.37 df = 1; p = NS
X^2 = 2.36 df = 2; p = NS

14. Pressure to achieve programme and lack of safety update undermines safety performance.

C 31 = C 36 = C 31

	A	B	C
S M = C 31	61	13	74
C M = C 36	32	24	56
S A = C 31	43	12	55

X^2 = 10.01 df = 1; p = S
X^2 = 5.60 df = 1; p = S
X^2 = 11.35 df = 2; p = VS

15. Safety is mostly a matter of commonsense.

C 32 = C 37 = C 32

	A	B	C
S M = C 32	44	30	74
C M = C 37	43	13	56
S A = C 32	40	9	55

X^2 = 4.32 df = 1; p = S
X^2 = 0.82 df = 1; p = NS
X^2 =10.08 df = 2; p = S

16. Individual carelessness is responsible for most accidents on site.

C 33 = C 38 = C 33

	A	B	C
S M = C 32	44	30	74
C M = C 38	47	9	56
S A = C 32	46	9	55

X^2 = 9.09 df = 1; p = S
X^2 = 0.00 df = 1; p = NS
X^2 =13.67 df = 2; p = VS

17. Urgency to achieve programme forces site management to pay less attention to safety on site.

C34 = C39 = C34

	A	B	C
S M = C34	68	6	74
C M = C39	35	21	56
S A = C34	44	11	55

X^2 = 16.73df = 1; p = VS
X^2 = 4.14df = 1; p = S
X^2 = 16.89df = 1; p = VS

18. Construction Team co-operation on site influences safety performance on site.

C 35= C 40= C 35

	A	B	C
S M = C 35	40	34	74
C M = C 40	52	4	56
S A = C 35	50	5	55

X^2 =23.20 df = 1; p = VS
X^2 = 0.14 df = 1; p = NS
X^2 =35.69 df = 2; p = VS

19. Site management's safety behaviour on site is a major influence on workers' safety behaviour.

C 36= C 41= C 36

	A	B	C
S M = C 36	71	3	74
C M = C 41	56	0	56
S A = C 36	54	1	55

X^2 = 2.32 df = 1; p = NS
X^2 = 1.03 df = 1; p = NS
X^2 = 2.52 df = 2; p = NS

20. Poor co-operation between sub-contractors on site undermines safety performance.

C37 = C42 = C37

	A	B	C
S M = C 37	71	3	74
C M = C 42	52	4	56
S A = C 37	55	0	55

X^2 = 0.60 df = 1; p = NS
X^2 = 4.08 df = 1; p = S
X^2 = 3.91 df = 2; p = NS

PROCEDURAL FACTORS

21. Investigating and reporting near-accidents leads to prevention of future accidents.

C38 = C43 = C 38

	A	B	C
S M = C 38	50	24	74
C M = C 43	46	10	56
S A = C 38	50	5	55

X^2 = 3.51 df = 1; p = NS
X^2 = 1.82 df = 1; p = NS
X^2 =10.83 df = 2; p = S

22. Considering safety procedures at tender stage is unecessary.

C 40= C 45= C 40

	A	B	C
S M = C 40	18	56	74
C M = C 45	14	42	56
S A = C 40	8	47	55

X^2 = 0.81 df = 1; p = NS
X^2 = 1.91 df = 1; p = NS
X^2 = 2.32 df = 2; p = NS

23. Provision of protective clothing etc by all firms, is necessary to improve safety on site.

C 41 = C 46 = C 41

	A	B	C
S M = C 41	60	14	74
C M = C 46	42	14	56
S A = C 41	47	8	55

X^2 = 0.71 df = 1; p = NS
X^2 = 1.91 df = 1; p = NS
X^2 = 1.96 df = 2; p = NS

24. Considering safety procedures and work methods at tender improves safety performance.

C 44 = C 49 = C 44

	A	B	C
S M = C 44	61	13	74
C M = C 49	45	11	56
S A = C 44	54	1	55

X^2 = 0.09 df = 1; p = NS
X^2 = 9.14 df = 1; p = S
X^2 = 9.28 df = 2; p = S

25. Providing all employees with safety manuals/booklets improves safety performance.

C46 = C50 = C46

	A	B	C
S M = C46	54	20	74
C M = C50	51	5	56
S A = C46	23	32	55

X^2 = 6.72 df = 1; p = S
X^2 = 30.29 df = 1; p = VS
X^2 = 196.89 df = 2; p = VS

TECHNICAL FACTORS

26. Workers should be discouraged from operating plant or equipment for which they have received no training.

C47 = C52 = C47

	A	B	C
S M = C 47	66	8	74
C M = C 52	48	8	56
S A = C 47	51	4	55

X^2 = 0.36 df = 1; p = NS
X^2 = 1.42 df = 1; p = NS
X^2 = 1.42 df = 2; p = NS

27. Provision of safety information to workers is lacking in the construction industry.

C 51 = C56 = C51

	A	B	C
S M = C51	42	32	74
C M = C56	38	18	56
S A = C51	39	16	55

X^2 = 1.66 df = 1; p = NS
X^2 = 0.12 df = 1; p = NS
X^2 = 3.19 df = 2; p = NS

28. Training of contract managers in health and safety is inadequate for efficient safety administration.

C 52 = C 57 = C 52

	A	B	C
S M = C 52	33	41	74
C M = C 57	26	30	56
S A = C 52	30	25	55

X^2 = 0.04 df = 1; p = NS
X^2 = 0.73 df = 1; p = NS
X^2 = 1.34 df = 2; p = NS

29. Wearing protective safety clothing and equipment reduces worker efficiency.

C 53 = C 58 = C 53

	A	B	C
S M = C 53	34	40	74
C M = C 58	22	34	56
S A = C 53	11	44	55

X^2 = 0.58 df = 1; p = NS
X^2 = 4.94 df = 1; p = S
X^2 = 9.52 df = 2; p = S

30. Present methods of tendering discriminate strongly against safety conscious contractors.

C55 = C60 = C 55

	A	B	C
S M = C 55	48	26	74
C M = C 60	41	15	56
S A = C 55	43	12	55

X^2 = 1.03 df = 1; p = NS
X^2 = 0.37 df = 1; p = NS
X^2 = 2.87 df = 2; p = NS

31. Work pressure and fatigue leads to accidents on site.

C56 = C61 = C56

	A	B	C
S M = C56	53	21	74
C M = C61	42	14	56
S A = C56	50	5	55

X^2 = 9.99 df = 1; p = S
X^2 = 4.95 df = 1; p = S
X^2 = 7.47 df = 2; p = S

ORGANISATIONAL FACTORS

32. More accidents occur when worker-management relationships are poor.

C57 = C62 = C57

	A	B	C
S M = C57	34	40	74
C M = C62	28	28	56
S A = C57	39	16	55

$X^2 = 0.21$ df = 1; p = NS
$X^2 = 5.07$ df = 1; p = S
$X^2 = 8.62$ df = 2; p = S

33. Trade Union involvement in safety reduces accidents on site.

C 58 = C 63 = C 58

	A	B	C
S M = C 58	33	41	74
C M = C 63	33	23	56
S A = C 58	39	16	55

$X^2 = 2.62$ df = 1; p = NS
$X^2 = 1.75$ df = 1; p = NS
$X^2 = 9.06$ df = 2; p = NS

34. Having safety representative on site improves safety standards/performance.

C59 = C64 = C59

	A	B	C
S M = C59	30	44	74
C M = C64	20	36	56
S A = C59	16	39	55

$X^2 = 0.31$ df = 1; p = NS
$X^2 = 0.56$ df = 1; p = NS
$X^2 = 1.80$ df = 2; p = NS

35. Site management and safety advisers etc, are responsible for site safety.

C 60 = C 65 = C 60

	A	B	C
S M = C 60	67	7	74
C M = C 65	44	12	56
S A = C 60	52	3	55

$X^2 = 3.66$ df = 1; p = S
$X^2 = 44.08$ df = 1; p = VS
$X^2 = 7.45$ df = 2; p = S

36. Management and workers co-operation essential for safe working.

C 61 = C 66 = C 61

	A	B	C
S M = C61	69	5	74
C M = C66	55	1	56
S A = C61	54	1	55

$X^2 = 1.79$ df = 1; p = NS
$X^2 = 0.00$ df = 1; p = NS
$X^2 = 2.99$ df = 2; p = NS

37. Managers and supervisors do not talk enough about safety to their workers.

C62 = C67 = C62

	A	B	C
S M = C62	50	24	74
C M = C67	39	17	56
S A = C62	49	6	55

$X^2 = 0.06$ df = 1; p = NS
$X^2 = 6.39$ df = 1; p = S
$X^2 = 8.75$ df = 2; p = S

38. Having safety committees improves safety standards of an organisation

C63 = C68 = C63

	A	B	C
S M = C63	58	16	74
C M = C68	34	22	56
S A = C63	45	10	55

X^2 = 4.81 df = 1; p = S
X^2 = 6.02 df = 1; p = S
X^2 = 7.63 df = 2; p = S

39. More Factory Inspectors in the building industry will improve health and safety performance.

C64 = C69 = C64

	A	B	C
S M = C 64	49	15	74
C M = C 69	21	35	56
S A = C 64	16	39	55

X^2 = 18.75df = 1; p = VS
X^2 = 0.88df = 1; p = NS
X^2 = 31.14df = 2; p = VS

40. Management safety attitudes determine workers' safety behaviour on site.

C 65= C 70= C 65

	A	B	C
S M = C 65	67	7	74
C M = C 70	44	12	56
S A = C 65	51	4	55

X^2 = 3.66 df = 1; p = S
X^2 = 4.51 df = 1; p = S
X^2 = 6.11 df = 2; p = S

41. Poor co-ordination of sub-contractors' work on site influences safety performance on site.

C 66 = C 71 = C 66

	A	B	C
S M = C 66	59	15	74
C M = C 71	49	7	56
S A = C 66	54	1	55

X^2 = 1.37 df = 1; p = NS
X^2 = 0.73 df = 1; p = NS
X^2 = 9.87 df = 2; p = S

ENVIRONMENTAL FACTORS

42. A single contractor responsibility for all scaffolding on site is important to the improvement of safety standards.

C 67 = C 72 = C 67

	A	B	C
S M = C 67	61	13	74
C M = C 72	48	8	56
S A = C 67	47	8	55

X^2 = 0.25 df = 1; p = NS
X^2 = 0.00 df = 1; p = NS
X^2 = 0.34 df = 2; p = NS

43. Untidy building sites do not lead to accident occurrence.

C 68 = C 73 = C 68

	A	B	C
S M = C 68	68	6	74
C M = C 73	51	5	56
S A = C 68	54	1	55

X^2 = 0.03 df = 1; p = NS
X^2 = 2.74 df = 1; p = NS
X^2 = 2.85 df = 1; p = NS

44. Provision of good quality welfare and first-aid facilities on site improves safety standards

C 69 = C 74 = C 69

	A	B	C
S M = C 69	54	20	74
C M = C 74	45	11	56
S A = C 69	50	5	55

X^2 = 0.96 df = 1; p = NS
X^2 = 2.50 df = 1; p = NS
X^2 = 6.48 df = 2; p = S

45 Providing workers with thermal/warm clothing in winter can lead to accident reduction.

C70 = C75 = C70

	A	B	C
S M = C70	42	32	74
C M = C75		19	56
S A = C70	41	14	55

X^2 = 1.16 df = 1; p = NS
X^2 = 0.95 df = 1; p = NS
X^2 = 4.43 df = 2; p = NS

46. Good job planning and site organisation improves safety performance.

C71 = C76 = C 71

	A	B	C
S M = C71	63	11	74
C M = C76	49	7	56
S A = C71	54	1	55

X^2 = 0.15 df = 1; p = NS
X^2 = 4.73 df = 1; p = S
X^2 = 6.26 df = 2; p = S

47. An inadequate supply of the right type of plant and quality of tools/equipment leads to accidents and damage on site.

C72 = C77 = C72

	A	B	C
S M = C72	63	11	74
C M = C77	53	3	56
S A = C72	51	54	55

X^2 = 3.00 df = 1; p = S
X^2 = 0.17 df = 1; p = NS
X^2 = 3.82 df = 2; p = S

48. Older workers' attitudes to safety and health on site is a major source of influence to new recruits to the construction industry. C 73 = C 78 = C 73	A	B	C
S M = C 73	54	20	74
C M = C 78	47	9	56
S A = C 73	44	11	55

X^2 = 2.21 df = 1; p = NS
X^2 = 0.29 df = 1; p = NS
X^2 = 2.38 df = 2; p = NS

49. Inadequate control and supervision of workers on site is a major factor in accident occurrence. C75 = C80 = C75	A	B	C
S M = C75	61	13	74
C M = C80	46	10	56
S A = C75	52	3	55

X^2 = 0.00 df = 1; p = NS
X^2 = 4.13 df = 1; p = S
X^2 = 4.79 df = 2; p = S

50. Workers and managers can reduce the causes of most accidents on site by being a little more thoughtful about safery provision. C 76= C 81= C76	A	B	C
S M = C 76	69	5	74
C M = C 81	43	13	56
S A = C 76	53	2	55

X^2 = 7.24 df = 1; p = VS
X^2 = 9.10 df = 1; p = VS
X^2 = 13.91 df = 2; p = VS

SAFETY PERFORMANCE FACTORS

51. Regular safety assessments on a competitive basis increases safety awareness.

C77 = C82 = C77

	A	B	C
S M = C77	57	17	74
C M = C82	38	18	56
S A = C77	48	7	55

X^2 = 1.38 df = 1; p = NS
X^2 = 5.99 df = 1; p = S
X^2 = 5.97 df = 2; p = S

52. The Health and Safety Inspectorate have inadequate resources to enforce safety in the constructive industry.
C78 = C83 = C 78

	A	B	C
S M = C78	55	19	74
C M = C83	42	14	56
S A = C78	50	5	55

X^2 = 0.01 df = 1; p = NS
X^2 = 4.95 df = 1; p = S
X^2 = 6.30 df = 2; p = S

53. Hazard identification, analysis, and updating by management would lead to improved safety performance on site.
C 79 = C 84 = C 79

	A	B	C
S M = C 79	69	5	74
C M = C 84	43	13	56
S A = C 79	50	5	55

X^2 = 7.24 df = 1; p = S
X^2 = 4.07 df = 1; p = S
X^2 = 8.73 df = 1; p = S

54. Efficient hazard identification and analysis as key management functions, is a key factor in encouraging improved safety performance

C80 = C85 = C80

	A	B	C
S M = C80	66	8	74
C M = C85	39	17	56
S A = C51	51	4	55

X^2 = 7.84 df = 1; p = S
X^2 = 9.64 df = 1; p = S
X^2 = 13.39 df = 2; p = VS

55. Displaying all accident information on sites, would prevent risk-taking by workers.

C 81 = C 86 = C 81

	A	B	C
S M = C81	55	19	74
C M = C86	29	27	56
S A = C81	23	22	55

X^2 = 7.08 df = 1; p = S
X^2 = 0.00 df = 1; p = NS
X^2 = 9.38 df = 2; p = S

56. Alcohol and drug abuse are not major problems for safety on site.

C82 = C87 = C82

	A	B	C
S M = C82	33	41	74
C M = C87	26	30	56
S A = C82	27	28	55

X^2 = 0.04 df = 1; p = NS
X^2 = 0.08 df = 1; p = NS
X^2 = 0.26 df = 2; p = NS

57. All companies in the build-industry should have alcohol & drugs policies.

C 83 = C 88 = C 83

	A	B	C
S M = C 83	53	21	74
C M = C 88	39	17	56
S A = C 83	47	8	55

X^2 = 0.06 df = 1; p = NS
X^2 = 3.98 df = 1; p = S
X^2 = 4.53 df = 2; p = S

58. Lack of proper consultation between clients, engineers, designers, managing contractors and sub-contractors undermine safety performance on site.

C 84 = C 89 = C 84

	A	B	C
S M = C 84	40	34	74
C M = C 89	42	14	56
S A = C 84	54	1	55

X^2 = 6.00 df = 1; p = S
X^2 = 12.76 df = 1; p = VS
X^2 = 31.64 df = 2; p = VS

59. Safety provisions in tender documents are too vague for promoting better safety on site.

C 85 = C 90 = C 85

	A	B	C
S M = C 85	40	34	74
C M = C 90	46	10	56
S A = C 85	48	7	55

X^2 = 11.23 df = 1; p = VS
X^2 = 0.56 df = 1; p = NS
X^2 = 21.23 df = 2; p = VS

60. Most accidents occur on multi-occupied sites due to inadequate control of sub-contractors.

C86 = C91 = C86

	A	B	C
S M = C 86	42	32	74
C M = C 91	39	17	56
S A = C 86	40	15	55

X^2 = 2.25 df = 1; p = NS
X^2 = 0.13 df = 1; p = NS
X^2 = 4.19 df = 2; p = S

APPENDIX : N:

List of Operative Accidents

Table 4.15(b)

TABLE 4.15(b) : ACCIDENT EXPERIENCES - TYPE OF ACCIDENTS BY OPERATIVES

		No	%
(a)	Falls from scaffolding/work platforms	10	8
(b)	Falls from or through roofs	2	2
(c)	Nails through feet/work shoes (not wearing proper safety boots)	124	98
(d)	Falls from heights during erection of steel work/ formwork	3	2
(e)	Falls due to collapse of scaffolding or other frame-works of platforms	8	7
(f)	Injury to eyes due to dust or debris, fumes or toxic substances	6	5
(g)	Falls of materials from heights above head level	3	2
(h)	Falls from untied ladders, and falls from ladders due to other reasons	2	2
(i)	Collapse of a trench/deep holes while working	6	5
(j)	Collapse or over-turning of crane or other lifting equipment on site	4	3
(k)	Accidents caused by transport vehicles, dumpers, lorries, trucks etc	1	1
(l)	Fire or explosions of any kind on site	9	7
(m)	Accidents caused due to electric shocks or from electric appliances on site	40	32
(n)	Any other types	126	100

APPENDIX : O:

Operative Ratings of Things they want but which are not done by their Companies

TABLE 4.14 (b) : RATINGS OF THINGS OPERATIVES WANT THEIR COMPANIES TO DO, WHICH ARE NOT CURRENTLY DONE BY THEM

SAFETY NEEDS		RATINGS	
		No	%
(i)	Have daily safety inspections on site	123	98
(ii)	Give safety training and inductions to all new recruits	121	96
(iii)	Give safety bonus to employees	124	98
(iv)	Provide all workers with safety boots, helmets etc	122	96
(v)	Give operatives and supervisors joint safety training	124	98
(vi)	All site access positions to be clearly marked	122	96
(vii)	Operatives are informed how, where and when to use all safety equipment/clothing	123	98
(viii)	All scaffolding inspected regularly before used	123	98
(ix)	All trenches well timbered	123	98
(x)	Workers sent home without pay if found drinking/ drunk on site	96	76
(xi)	All openinging in floors are well protected with tapes, railings, etc	103	81
(xii)	Leading-Edges are regularly inspected on site	108	86
(N = 126)			

APPENDIX : P:

Tables of Historical (etc) Data

DATA

Appendix P

age	*service*	*industry*	*money*	*banksman*	*bonus*	*blindeye*	*reduce*	*risks*	*product*	*cares*
4	2	2	1	1	5	2	2	1	2	4
5	3	5	4	3	4	4	4	1	1	1
4	3	3	2	3	4	4	4	4	2	2
2	2	2	1	3	4	4	2	1	1	4
3	3	4	5	2	5	2	2	2	2	5
2	2	3	1	4	4	5	1	2	5	4
5	2	6	1	1	5	2	2	1	2	4
10	2	10	1	4	4	4	1	1	4	4
2	2	3	1	4	4	4	1	2	4	5
6	2	8	4	1	4	4	1	2	4	5
8	2	8	1	2	5	4	2	2	1	2
7	2	7	2	2	2	2	2	4	2	3
5	4	6	4	1	2	2	1	2	2	2
6	3	6	5	5	5	5	5	2	1	2
5	4	5	5	4	2	2	2	2	2	2
2	2	2	1	3	2	2	2	4	2	3
3	1	3	1	3	4	4	2	2	2	3
8	3	6	4	3	2	3	2	2	2	4
3	2	2	2	3	5	3	2	2	3	3
4	3	3	2	4	4	4	4	2	2	3
2	1	1	3	3	2	2	2	2	3	2
5	5	5	4	4	2	2	4	2	2	4
5	3	5	2	3	3	3	2	2	2	3
9	5	9	4	3	4	4	4	2	2	2
2	2	2	4	4	3	3	3	1	1	4
6	6	6	4	4	2	4	2	2	2	3
3	2	3	1	2	4	1	1	2	1	5
5	3	6	2	3	2	4	4	2	2	4
5	3	4	1	4	4	4	1	1	1	4
6	5	6	4	4	2	4	2	2	2	3
4	3	4	2	4	4	4	4	4	2	4
3	3	4	2	5	2	2	3	2	2	2
5	5	5	5	1	2	2	4	2	4	5
1	1	1	3	3	5	1	1	2	5	1
4	4	4	1	2	4	1	2	1	1	4
2	0	3	2	2	4	4	4	2	2	4
3	3	2	3	2	2	2	2	3	4	4
3	2	2	2	3	3	2	2	1	2	3
9	8	8	3	2	2	2	2	1	1	4
2	2	2	3	2	3	4	2	1	2	4
4	3	3	3	3	3	2	2	2	2	3
3	3	4	3	3	4	4	2	4	2	3
6	2	7	3	3	3	3	2	2	3	3
5	2	7	3	3	3	3	3	2	3	4
7	5	7	3	3	3	3	2	4	2	3
3	2	2	3	3	3	2	2	2	3	4
5	6	6	2	2	2	4	2	2	2	4
9	5	7	1	1	1	1	1	5	1	5
3	2	4	2	4	2	4	2	5	1	2
6	4	4	1	2	2	1	1	2	1	5
2	2	3	1	2	2	1	1	2	1	5
6	5	1	1	3	1	1	3	2	1	4
4	2	3	1	3	4	4	2	1	1	1
6	4	6	1	5	4	5	3	3	1	1
4	2	2	1	4	4	4	2	5	2	5
6	5	7	4	4	2	4	2	2	2	2
6	3	7	2	4	1	1	3	1	1	1
5	2	4	4	1	4	4	4	2	2	2
4	1	3	1	5	5	5	1	2	1	2
4	2	5	4	4	3	4	4	2	2	2
2	2	2	3	1	2	2	2	2	2	3
10	2	10	2	4	4	4	4	2	2	3
1	1	2	5	2	4	5	4	4	1	4
9	1	7	3	4	3	3	2	2	2	2
8	2	8	2	2	1	1	1	4	2	5
6	1	7	3	3	3	2	4	2	2	4
2	2	3	3	3	3	3	3	2	3	3
2	2	2	2	3	3	2	4	4	3	2
3	2	3	1	3	3	3	2	4	3	2
3	1	2	2	4	2	4	4	1	1	5
8	3	3	1	2	5	5	1	2	2	1
8	2	2	1	3	4	4	1	2	1	2
8	3	3	1	4	4	2	2	4	2	4
9	4	4	2	4	4	2	2	2	1	3
5	1	6	1	1	5	5	1	5	1	5
4	3	4	2	3	2	2	2	4	2	2
6	6	6	1	3	1	2	1	2	3	1
2	2	2	1	3	4	2	2	4	2	2
2	2	2	2	3	4	4	1	2	2	1
8	4	8	4	3	2	2	1	2	2	1
2	2	2	3	3	4	4	2	4	2	2
2	2	3	2	3	4	2	1	2	2	2
2	2	2	3	3	2	2	2	4	2	2
1	2	2	3	4	2	2	2	2	2	3
8	5	6	4	2	2	2	3	3	2	2
9	6	6	2	2	4	4	1	2	1	2
2	2	2	2	1	1	4	3	2	1	5
4	2	4	2	1	4	4	4	4	2	3
5	3	5	4	2	4	4	4	2	4	4
2	1	1	3	4	4	3	3	4	3	4
6	6	5	2	2	2	2	2	2	3	3
10	8	7	4	4	3	3	3	2	2	2
6	2	7	3	1	5	5	1	5	1	1
7	5	8	5	2	2	2	4	2	2	2
2	2	2	3	2	2	2	2	2	2	2
3	3	3	2	3	4	4	4	4	2	2
7	2	6	2	2	4	4	4	4	1	1
7	3	6	4	2	2	2	2	2	2	2
4	5	5	1	3	4	4	4	2	2	2
4	3	4	1	1	2	1	2	2	1	5
1	2	2	2	3	2	4	4	2	2	2
2	3	3	3	3	4	3	2	2	2	2
4	3	5	5	4	1	1	2	3	2	4
2	2	3	4	4	2	2	2	4	2	5
4	2	5	2	3	3	4	3	4	2	4
4	3	5	1	5	1	1	3	3	4	5
3	3	4	1	2	4	2	1	4	2	2
4	3	4	1	2	5	4	2	4	2	4
5	2	6	2	4	2	4	2	2	4	4
2	2	2	2	4	2	2	4	2	4	4
3	2	4	2	3	3	2	2	2	4	4
8	4	8	2	2	1	1	2	1	2	4
9	3	9	5	2	4	4	3	2	2	2
4	5	5	3	3	4	4	2	2	1	2
7	7	7	2	3	2	4	2	2	2	2
5	4	6	4	3	2	3	1	2	1	2
2	1	2	2	2	2	2	2	2	2	4
5	2	6	4	2	2	2	4	2	2	2
2	2	2	4	2	2	4	4	2	2	4
6	2	3	4	2	4	4	4	2	2	4
6	3	6	2	2	2	4	4	2	2	1
5	2	3	4	4	4	4	4	4	2	4
5	2	5	2	2	4	4	4	2	2	4
7	4	5	2	2	5	5	1	5	1	2
3	2	2	4	2	2	4	4	2	2	2
3	2	3	2	2	4	4	4	2	2	4

Appendix P

safety	*workmate*	*safeact*	*training*	*risky*	*skillful*	*careful*	*site*	*like*	*helmet*	*wear*
1	2	2	2	2	4	4	4	1	1	4
1	4	2	2	2	4	2	4	1	4	1
2	4	2	2	4	4	4	4	1	2	4
1	5	2	2	2	2	2	4	1	1	3
1	5	3	2	5	1	3	1	1	2	4
2	5	2	2	4	2	2	2	1	1	2
4	5	1	2	4	5	1	5	2	2	2
1	1	2	2	4	2	2	4	1	2	2
3	2	5	2	2	5	2	2	2	5	1
4	4	2	4	4	4	1	5	2	5	1
1	4	4	4	2	4	2	4	1	1	2
2	4	2	2	4	2	2	4	1	2	4
1	4	2	2	2	2	2	4	1	1	2
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1	5	2	2	4	2	2	4	1	1	1
1	4	3	2	2	2	2	4	1	1	1
2	4	3	2	2	2	2	4	1	1	2
1	4	4	2	2	2	2	4	2	1	2
1	4	3	2	2	2	3	4	1	1	2
1	4	3	2	2	2	2	5	2	1	2
1	3	3	3	2	3	3	3	2	1	3
1	4	3	2	2	2	3	5	1	2	2
1	5	2	2	4	2	2	4	1	2	3
1	4	4	2	4	2	2	4	1	1	2
1	5	1	1	2	1	1	5	1	2	3
2	4	4	2	2	2	2	4	1	2	2
1	5	4	1	4	2	1	4	1	1	1
2	2	2	2	4	2	2	4	1	2	2
1	5	2	1	1	2	2	4	1	2	2
2	4	4	2	4	2	2	4	1	2	2
1	5	2	2	4	2	3	5	1	3	4
1	1	2	2	2	2	2	4	1	1	2
2	4	4	4	4	2	2	2	1	1	2
1	2	4	2	1	1	1	5	1	1	5
1	5	4	2	2	2	2	4	1	4	2
2	4	3	2	2	1	2	3	2	2	2
2	3	2	2	2	2	2	2	2	2	2
2	2	1	2	2	3	1	4	1	1	2
1	4	3	2	2	4	3	3	1	2	2
1	4	2	2	2	3	2	4	1	1	2
2	2	2	1	1	3	2	3	1	2	2
2	4	3	2	2	3	3	3	1	2	3
2	4	4	3	2	3	3	3	1	2	3
2	4	4	3	2	3	3	2	2	3	4
2	4	3	2	3	3	2	2	1	2	2
4	3	2	3	3	3	1	5	1	3	3
2	2	4	4	2	4	2	4	1	2	4
1	1	2	2	4	1	4	5	1	1	2
1	5	2	2	3	1	2	4	1	1	3
1	4	3	2	2	4	4	5	1	1	5
2	4	3	2	2	4	4	5	1	1	4
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1	5	1	1	2	4	2	4	1	2	2
1	5	1	2	4	3	1	5	1	1	2
1	5	2	2	5	2	2	5	1	1	5
1	4	2	2	4	4	2	4	1	2	2
1	1	1	1	4	2	2	4	1	1	2
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5	2	2	4	5	4	5	1	5	1	1
2	5	2	2	4	4	5	5	2	2	2
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2	4	2	2	4	2	2	4	1	2	3
1	4	2	2	4	2	2	2	1	1	1
2	4	4	2	2	2	2	4	1	2	2
2	4	3	3	2	3	2	4	1	4	4
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2	4	2	2	2	3	3	3	2	2	3
1	4	5	1	2	5	4	2	2	1	1
1	4	2	2	4	4	1	4	1	1	4
1	5	2	2	4	2	2	4	1	1	2
1	4	2	2	2	2	2	4	1	2	2
1	5	2	2	2	2	1	4	1	2	2
1	1	1	1	4	1	1	4	1	1	1
1	2	2	2	4	2	2	4	1	2	2
2	2	2	2	4	3	2	4	1	1	3
1	1	1	1	1	1	1	1	1	1	3
1	2	2	2	4	2	2	4	1	1	1
1	4	2	2	5	2	2	1	1	2	2
1	5	2	2	5	2	2	2	1	1	3
1	1	1	2	4	2	2	2	1	1	2
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1	5	2	2	2	3	2	3	1	2	3
1	2	4	2	2	2	4	4	2	1	1
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1	5	3	3	2	2	2	4	1	4	4
1	4	3	2	4	3	2	4	1	2	2
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1	4	2	2	4	4	2	4	1	1	2
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1	5	2	1	4	1	1	2	1	1	2
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1	5	1	1	4	2	2	4	1	1	5
2	4	3	2	4	4	2	2	1	1	4
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2	4	2	2	2	2	2	4	1	1	2
2	4	2	2	4	2	2	4	1	1	2
1	4	2	2	2	2	2	4	1	1	2
2	4	4	2	2	2	2	2	1	2	2
2	4	4	2	4	2	2	4	1	1	2
1	5	1	1	4	1	1	5	1	1	2
1	4	2	2	4	2	2	4	1	1	2
2	4	4	2	2	2	2	4	1	1	2

Appendix P

protect	equip	safebook	talk	believe	asbestos	asbesite	handle	tell	mechan	scaffold
1	4	2	2	2	1	2	2	2	1	1
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2	2	1	1	1	1	2	4	5	1	1
1	2	2	2	5	2	5	2	2	2	4
4	2	1	1	3	1	1	4	4	1	1
2	2	2	1	1	1	1	2	4	5	1
2	2	1	1	1	2	2	4	4	4	1
1	2	2	2	2	1	1	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2
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1	1	1	1	1	1	3	1	5	1	1
1	1	1	1	1	1	2	2	4	2	2
2	2	2	1	1	1	3	2	5	2	2
2	2	2	2	2	1	2	2	4	2	2
2	2	2	2	2	1	3	4	4	2	2
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2	1	1	1	1	1	5	5	5	2	3
2	2	2	2	2	1	3	5	5	1	1
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2	2	2	2	2	2	3	2	5	2	2
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2	2	2	2	2	1	2	1	5	2	1
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2	2	2	2	2	1	4	4	4	2	2
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2	2	4	2	2	1	4	4	5	2	2
2	2	2	1	2	1	3	2	4	1	2
4	4	4	4	1	2	2	4	2	2	2
2	2	2	2	2	2	2	2	5	2	2
2	2	1	1	1	2	3	4	5	2	2
2	1	2	2	2	2	3	3	5	1	1
2	2	1	1	1	1	2	1	5	3	2
2	2	1	1	1	2	3	2	4	1	2
2	1	1	1	1	1	2	2	5	1	1
2	2	2	2	2	2	4	4	4	2	2
2	2	2	2	2	2	3	2	4	2	2
3	3	3	3	3	2	4	3	3	2	2
2	2	2	2	2	2	4	2	4	2	2
2	3	3	3	3	2	3	3	3	2	2
2	4	2	2	2	2	2	2	4	2	2
1	1	1	1	1	1	1	1	5	1	1
1	2	2	2	2	1	1	2	5	1	2
1	2	2	2	1	1	1	1	5	2	2
1	1	2	2	1	1	1	1	5	2	2
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1	1	1	1	2	1	1	1	5	1	1
1	1	1	1	1	1	5	1	3	1	1
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2	2	2	2	2	1	1	2	4	2	2
1	1	1	1	1	1	2	4	4	2	1
1	2	2	3	2	1	2	2	4	1	1
1	1	1	1	2	2	3	2	4	2	1
2	2	2	2	2	1	3	4	5	2	2
1	1	1	1	1	5	1	1	5	5	5
2	2	2	2	2	1	2	1	5	1	1
2	4	2	2	2	2	2	2	4	2	2
2	2	2	2	2	1	2	4	4	1	1
1	1	1	1	1	1	1	1	5	1	1
2	2	2	2	3	2	2	2	4	2	2
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2	2	3	2	2	2	3	4	4	2	2
2	2	2	4	3	1	2	4	4	2	2
1	1	1	1	1	1	5	4	4	1	1
1	2	5	3	3	2	1	2	1	5	5
2	2	2	2	2	1	2	2	5	1	2
2	2	2	2	2	1	4	5	5	2	2
1	2	2	2	1	1	2	4	5	2	1
1	1	1	1	1	5	1	4	5	1	1
2	2	2	2	2	1	3	2	4	2	2
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2	2	2	2	2	1	4	2	4	2	2
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2	2	2	2	2	1	2	2	4	4	2
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1	1	1	1	1	1	1	3	3	1	1
1	1	1	1	1	2	2	4	3	2	2
3	3	4	4	3	2	2	2	2	2	2
2	2	2	2	2	1	1	1	2	1	1
2	2	2	4	4	1	4	4	4	2	2
4	4	3	4	4	3	3	3	4	4	4
2	2	2	3	3	2	3	3	3	2	2
3	2	3	3	3	2	2	2	2	4	4
1	1	1	1	1	1	3	1	5	2	1
2	2	2	2	2	1	2	2	4	2	2
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2	2	2	2	2	1	4	2	4	2	2
1	1	1	1	1	1	4	1	4	1	1
2	2	2	2	2	2	2	2	4	2	2
2	2	2	2	2	1	2	2	4	2	2
1	1	1	1	2	1	4	2	5	1	2
1	2	3	2	4	1	2	2	5	2	2
1	2	2	2	2	2	4	4	5	1	1
1	1	1	1	1	1	1	1	3	1	1
1	1	1	1	1	1	3	3	3	2	2
2	2	2	2	2	2	2	2	4	2	2
1	1	1	1	1	1	1	5	3	1	1
1	2	1	1	2	1	1	1	4	1	1
2	2	2	2	2	2	2	4	4	2	2
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2	2	2	2	2	2	3	4	3	2	2
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2	2	2	2	2	1	3	1	5	2	1
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2	2	2	2	2	1	2	2	2	1	2
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2	2	2	2	2	1	4	2	5	2	2
2	2	2	2	2	2	4	4	4	2	2
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Appendix P

proper	*sense*	*erector*	*dumper*	*operate*	*relation*	*involve*	*subcont*	*saferep*	*cooperat*	*commitee*
5	4	5	4	2	2	2	1	2	2	4
4	4	4	4	2	1	4	4	4	1	1
4	4	2	2	4	2	2	4	2	2	2
5	4	4	2	1	2	2	4	2	2	2
4	5	5	4	1	2	3	2	2	5	3
4	2	5	4	1	1	2	2	1	1	1
4	1	2	1	1	1	2	2	2	4	4
4	4	1	4	1	1	2	1	2	1	2
1	4	1	5	4	1	1	2	2	1	1
2	4	2	5	4	1	1	1	2	1	1
4	2	4	4	1	2	1	1	1	1	2
4	4	4	2	2	2	4	2	2	1	2
5	5	5	5	1	4	2	1	1	2	2
5	5	2	2	1	1	4	1	1	1	1
4	4	4	4	2	4	3	4	1	1	2
4	4	5	4	2	2	3	2	2	2	2
4	4	4	4	2	1	2	1	2	2	2
3	4	4	4	2	1	4	2	3	2	2
1	5	5	4	1	1	1	2	1	2	1
5	5	2	3	3	2	3	2	3	2	2
3	4	4	3	3	2	3	3	3	2	3
5	5	5	5	1	1	4	2	3	1	2
5	5	5	1	1	1	2	1	2	1	3
4	2	4	4	2	2	3	2	3	2	3
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4	5	5	4	2	2	2	4	2	2	2
5	5	4	5	1	1	1	1	1	1	1
5	5	5	4	2	4	2	2	2	1	1
5	5	5	5	2	2	2	2	2	2	2
4	5	5	4	2	2	2	4	2	2	2
5	5	5	5	1	4	2	1	2	2	2
5	5	2	5	2	2	2	1	2	2	3
4	4	4	2	4	2	2	4	2	2	4
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2	3	3	2	4	3	4	4	2	2	2
3	1	4	2	3	3	3	2	3	2	2
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5	5	1	1	1	2	2	2	2	2	2
4	5	4	4	1	3	1	1	1	2	2
5	5	5	5	1	1	1	1	1	1	1
5	5	5	5	1	3	1	3	1	1	1
4	5	4	4	5	5	2	4	2	2	2
4	4	4	4	2	2	2	2	2	2	2
4	4	2	4	2	1	2	1	2	2	2
4	4	4	4	2	2	2	4	2	2	2
4	4	4	2	1	1	4	4	1	1	2
2	5	5	1	2	3	4	2	2	2	2
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5	5	5	4	2	1	4	2	2	2	2
4	4	2	4	4	2	2	2	2	2	2
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4	4	4	4	4	1	3	1	3	2	3
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2	4	4	4	4	4	1	3	1	3	1
4	4	4	4	2	1	3	1	3	1	1
5	4	5	3	2	2	3	2	1	1	5
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5	5	5	1	2	2	4	1	1	1	1
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4	4	4	4	2	4	2	4	2	2	2
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4	4	2	4	2	2	3	4	2	2	2
5	5	5	4	2	2	2	1	1	1	2
5	5	5	4	3	1	2	5	2	1	2
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3	4	4	2	2	1	1	1	1	1	1
4	2	4	2	2	2	2	2	2	2	2
5	5	4	2	4	1	2	5	2	2	2
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4	4	4	4	2	2	4	2	4	2	4
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4	4	4	4	2	2	4	2	4	2	2
4	4	4	4	2	2	2	2	4	2	2

enough	superv	posters	tidysite	jobs	cause	lessacci	toxic	examples	plan	avoid
2	2	4	2	2	4	2	2	1	2	2
1	1	4	1	1	4	1	3	2	1	1
2	2	1	4	4	2	2	4	2	2	4
2	2	2	1	1	4	2	2	2	1	2
2	4	2	2	5	4	2	2	3	5	2
2	4	2	1	1	4	2	4	2	2	1
4	2	2	2	4	4	2	2	2	1	2
2	2	2	2	1	1	2	2	1	1	1
1	2	4	3	1	1	4	4	2	4	2
2	2	4	3	1	1	4	2	4	2	2
2	2	1	1	2	5	2	2	2	1	1
1	4	2	1	5	1	3	2	2	2	4
2	1	2	2	5	2	4	4	2	2	3
2	4	2	1	5	1	4	1	1	2	3
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3	4	3	1	1	4	2	4	2	2	2
3	3	2	2	2	5	2	3	2	1	1
2	3	2	2	1	4	2	3	2	2	2
2	4	2	1	1	4	2	3	1	1	1
3	2	1	3	2	3	2	3	2	2	2
2	4	2	2	2	4	1	4	2	1	2
3	2	2	2	3	2	3	2	2	2	4
3	3	3	2	3	3	2	3	3	2	2
2	4	4	2	1	4	1	3	2	2	1
2	4	2	2	4	2	4	3	3	3	2
4	1	1	1	1	5	1	1	4	1	1
2	4	2	2	5	2	2	4	2	2	2
2	4	2	2	2	2	2	2	4	2	2
2	4	2	2	2	3	2	4	2	2	2
3	1	2	2	2	4	2	2	4	1	2
1	2	2	2	2	1	2	4	2	1	1
2	4	4	2	2	4	2	4	4	2	2
2	2	4	3	1	5	1	2	1	1	1
2	4	1	2	1	4	5	3	4	2	1
2	4	4	2	2	4	2	2	2	2	2
3	2	2	2	3	4	4	2	2	3	3
4	2	2	2	2	4	3	2	3	2	2
3	3	1	2	2	3	3	2	2	3	2
5	2	2	2	4	3	4	2	2	2	2
3	2	2	1	1	5	4	2	3	2	2
4	2	3	2	3	3	3	4	2	2	2
3	4	3	2	2	4	2	4	2	2	2
4	2	3	2	3	3	3	2	3	2	2
2	4	2	2	2	4	3	4	2	2	2
5	2	3	2	3	4	3	2	3	2	3
2	2	4	2	2	4	2	2	4	4	4
5	5	1	1	1	5	1	1	4	2	1
2	2	2	2	2	4	2	3	4	2	1
4	2	2	2	2	5	2	3	4	2	2
4	4	2	1	2	5	1	2	2	1	1
2	2	2	2	2	4	2	4	3	2	2
1	4	2	1	2	4	2	4	4	2	2
1	5	1	1	1	5	1	1	4	1	2
5	5	5	2	2	4	2	4	4	2	2
2	2	2	2	2	2	2	2	2	2	2
2	2	2	1	2	5	2	2	2	2	2
2	4	2	2	2	2	2	4	2	2	2
2	4	2	2	1	2	3	4	2	2	4
4	2	1	2	2	4	2	2	2	2	2
2	2	1	2	2	2	2	4	4	2	2
2	4	2	1	2	5	4	2	4	2	2
2	4	2	2	2	2	2	2	2	2	2
2	2	2	2	2	4	2	2	4	2	2
4	4	2	1	2	5	2	1	2	2	2
2	3	2	2	2	4	2	2	2	2	2
5	4	3	2	2	4	2	3	3	3	3
3	3	3	2	3	4	3	3	2	2	2
3	3	3	2	3	4	3	3	3	2	2
3	3	2	1	1	5	1	5	1	1	1
2	4	4	3	2	2	5	3	4	3	2
2	4	2	1	5	1	2	3	2	2	1
2	2	2	2	2	4	2	2	4	2	2
3	3	3	5	2	2	2	1	1	1	1
1	1	1	1	1	5	1	5	5	1	1
2	2	1	2	2	4	2	3	2	2	2
2	2	1	2	2	4	2	3	3	2	2
2	2	1	1	1	1	3	3	2	2	2
1	2	1	1	2	4	1	4	2	1	1
1	2	1	2	2	4	2	3	2	2	2
3	1	2	1	1	1	1	1	1	1	2
3	1	2	2	2	2	2	1	3	1	1
1	2	1	2	2	4	2	3	2	2	2
3	2	1	3	1	2	5	2	2	2	2
2	2	3	2	2	3	2	3	2	1	1
2	4	1	3	2	2	2	4	3	2	2
2	4	3	1	1	5	2	3	2	2	2
3	4	2	2	3	4	2	3	2	2	3
2	4	2	3	1	2	4	2	2	2	2
4	4	2	3	2	2	2	4	4	2	2
4	4	4	4	4	3	3	4	3	4	3
2	2	4	2	2	3	3	4	4	3	2
2	5	1	1	1	5	2	5	4	1	1
2	4	2	2	2	4	2	4	2	2	2
2	2	2	2	2	4	2	4	4	2	2
2	4	2	2	2	3	2	4	2	2	2
1	4	1	1	1	4	1	4	1	1	1
2	2	2	2	2	4	2	4	4	2	2
2	4	2	3	2	2	4	2	4	4	2
5	2	2	2	4	4	2	2	2	2	2
2	4	2	2	2	4	2	4	3	2	2
4	4	2	2	1	5	1	2	2	2	1
4	1	2	1	1	5	1	2	1	1	2
1	4	2	2	2	4	2	2	2	2	2
4	2	2	2	2	4	2	2	3	2	2
4	2	4	2	2	4	2	2	4	2	2
2	1	1	1	2	5	1	1	1	1	1
4	2	2	2	2	4	2	2	4	2	2
4	2	3	2	2	4	2	3	2	3	4
4	2	2	2	2	4	2	2	2	2	2
4	2	2	2	2	4	2	2	2	4	1
4	2	4	1	2	1	2	5	2	1	2
2	4	2	1	1	4	1	4	2	2	2
2	2	2	1	2	4	2	1	3	2	2
1	4	2	2	2	5	2	2	2	2	2
2	2	3	1	1	4	2	2	1	1	1
2	4	2	2	2	4	2	4	2	2	2
2	4	2	2	2	4	2	4	2	2	2
2	4	2	2	2	4	2	4	2	2	2
4	2	2	2	2	4	2	4	2	2	2
5	4	2	1	1	5	1	4	2	1	1
2	4	2	2	4	2	4	2	2	2	2
4	2	2	2	2	4	2	4	2	2	2
1	4	2	1	1	5	1	2	2	1	1
2	4	2	2	2	4	2	4	2	2	2
2	4	4	2	2	4	2	4	4	2	2

Appendix P

safeinsp	platform	roofs	shoes	heights	collapse	eyes	falls	ladders	holes	crane
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
6	0	0	0	10	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	7	0	0	0	1	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	4	0	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	2	0	0	0	0
6	0	0	0	0	0	0	0	0	5	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	1	0	0	0	4	0	0	0
3	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	6
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	3	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	7	0	0	0	1	0	0	0	5
6	0	0	0	0	1	0	0	0	5	6
6	0	0	0	0	0	0	0	0	0	0
6	7	8	0	0	1	2	3	4	5	0
7	0	0	0	1	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	5	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	2	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	7	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	10	4	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	7	0	0	0	1	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	9	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	2	0	0	0	0	0
6	7	0	0	0	0	2	0	0	0	0
6	7	0	0	0	0	0	0	0	0	0
1	0	0	0	0	2	0	0	0	0	0
5	7	0	0	0	0	0	0	0	0	0
6	7	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	5	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
3	7	0	0	0	0	2	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	1	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	5
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	5	0
6	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	2	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
2	7	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0

Appendix P

transpot	*fires*	*shocks*	*howmuch*	*perform*
0	0	0	0	0
0	0	1	2	1
10	1	1	2	12
0	10	2	2	22
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	3	9
0	0	0	0	0
0	0	1	3	1
0	0	2	3	2
0	0	0	0	0
0	0	1	3	5
0	0	0	0	0
0	0	0	4	2
0	0	2	1	7
0	0	0	0	0
0	0	2	4	7
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	2	7
0	0	0	0	0
0	0	1	4	4
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	7	0	2	20
0	0	1	1	13
0	0	0	0	0
0	0	1	2	31
0	0	1	2	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	4	6
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	2	3	2
0	0	0	2	2
0	0	0	0	0
0	0	0	0	0
0	8	1	2	9
0	0	2	2	9
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	2	1
0	0	2	2	16
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	2	5	10
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	8	1	1	18
0	1	2	2	3
0	0	0	0	0
0	0	1	1	3
0	0	2	2	11
0	0	1	2	8
0	1	0	2	3
0	0	1	1	8
0	0	1	2	8
0	0	0	0	0
0	0	0	0	0
0	0	1	3	1
0	0	0	0	0
0	0	1	3	6
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	2	10
0	0	0	0	0
0	0	0	0	0
0	0	1	2	1
0	0	2	3	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1	1	2
0	0	0	0	0
0	0	0	0	0
0	8	1	2	14
0	0	0	0	0
0	0	0	0	0
0	0	1	4	6
0	0	0	0	0
0	0	2	2	4
0	8	1	2	9
0	0	0	0	0
0	0	0	0	0
0	0	2	1	9
0	0	0	0	0
0	0	2	4	2

TABLE 4.2

Q.2. Are you working for a Managing Contractor on this job?

RESPONSE TYPE:	Row	Frequency Count	Percentage
(a) Yes	1	69	54.76
(b) No	2	51	40.48
(c) Don't know	3	6	4.76
TOTAL:	(N) =	126 =	100%

TABLE: 4.3 : THE CROSS-SECTIONAL STUDIES : SAMPLE SIZES ACCORDING TO OCCUPATION

Q.3. What is your job or trade?

OCCUPATION	SAMPLE SIZE	PROPORTIONS OF TOTAL (%)
General labourers	46	36.51
Carpenters/joiners	26	20.63
Bricklayers	16	12.70
Masons/pavers	-	-
Slaters/tilers (floor, wall & ceilings)	2	1.59
Plasterers	-	-
Painters/decorators	5	3.97
Plumbers/gas fitters	2	1.59
H & V Engineering workers	2	1.59
Glaziers	1	0.79
Steel erectors/sheeters	-	-
Scaffolders	6	4.76
Electricians	2	1.59
Mechanical/plant operators	6	4.76
Banksmen	5	3.97
Others	6	4.76
Missing data	1	0.79
TOTAL (N)	126	100.00

TABLE 4.4

Q.4. If you are a tradesperson, how did you learn your trade?

Trade/craft training:	Row	Frequency Count	Percentage Score
(a) By apprenticeship (post-school)	1	38	30.16
(b) Technical College (F/T)	2	9	7.14
(c) Technical College (P/T)	3	6	4.76
(d) Apprenticeship with no pre-school education	4	9	7.14
(e) Other methods	5	17	13.13
(f) Acquired by experience	6	46	36.51
(g) Uncertain	7	1	0.79
TOTAL:	(N)	= 126	100%

TABLE 4.5

Q.5. Do you belong to a trade union?

Response Type:	Row	Frequency	Percentage Score
(a) Yes	1	60	47.62
(b) No	2	66	52.38
TOTAL:	(N)	= 126	100%

TABLE 4.6

Q.6. If yes, which trade union do you belong to?

Response Type:	Row	Frequency	Percentage Score
(a) UCAAT	1	65	51.59
(b) T GWU	2	38	30.16
(c) Others	3	23	18.25
TOTAL:	(N)	= 126	100%

TABLE 4.9

Q.9. How long have you worked in the building industry?

INDUSTRY WIDE EXPERIENCE Classification		Row	Frequency Count	Percentage Score
(a)	Less than 1 year	1	4	3.17
(b)	1-5 years	2	27	21.43
(c)	6-10	3	22	17.46
(d)	11-15	4	16	12.70
(e)	16-20	5	1	0.79
(f)	21-25	6	19	15.08
(g)	26-30	7	12	9.52
(h)	31-35	8	7	5.56
(i)	36-40	9	2	1.59
(j)	41 years and over	10	2	1.59
	TOTAL	(N)	= 126	100%

4.4.2 Site Management Questionnaire - Results

1. SECTION ONE : HISTORICAL/BIOGRAPHICAL FACTORS (Sample Population (N)=74)

Q.1. What type of firm do you work for?

TABLE 4.16

NO.	TYPE	FREQUENCY	PERCENTAGE
1.	Main contractor	60	81.08
2.	Sub-contractor	3	4.05
3.	Govt./Local Authority	NIL	-
4.	Self-employed	1	1.35
5.	Management Contractor	9	12.16
6.	Project Management	1	1.35
7.	Others	NIL	-
	TOTAL	N = 74	100%

Q.2. If your firm is a sub-contractor, are you working on this project for a:

TABLE 4.17

NO.	TYPE	FREQUENCY	PERCENTAGE
1.	Main Contractor (traditional)	55	74.32
2.	Managing Contractor	11	14.86
3.	Project Manager	NIL	-
4.	Others	8	10.82
	TOTAL (N) =	74	100%

Q.3. What is the nature of your firm's work or trade?

TABLE 4.18

NO.	TYPE	FREQUENCY	PERCENTAGE
1.	General Builders	19	25.68
2.	Building & civil engineering	43	58.11
3.	Civil engineering only	9	12.16
4.	Painters & decorators	1	1.35
5.	Plasterers	2	2.70
6.	Others	NIL	-
	TOTAL (N) =	74	100%

Q.4. What is your job or position?

TABLE 4.19

NO.	TYPE	FREQUENCY	PERCENTAGE
1.	Site Manager/Agent	39	52.70
2.	General Foreman	13	17.57
3.	Trade Foreman/chargehand	2	2.70
4.	Supervisor	NIL	-
5.	Project Manager	15	20.27
6.	Section Manager	4	5.41
7.	Others	1	1.35
	TOTAL (N) =	74	100%

Q.5. What trade or craft did you come from (your trade background)?

TABLE 4.20

NO.	TYPE	FREQUENCY	PERCENTAGE
1.	Bricklayer	4	5.41
2.	Carpenter & Joiner	23	31.08
3.	Painter & Decorator	1	1.35
4.	Plasterer	1	1.35
5.	Roofer/slater	NIL	-
6.	Scaffolder	1	1.35
7.	Plumber	NIL	-
8.	Electrician	1	1.35
9.	Plant Operator/fitter	2	2.70
10.	General Labourer	2	2.70
11.	University Graduate	21	28.38
12.	Technical College Educated	17	22.97
13.	Others	1	1.35
	TOTAL (N) =	74	100%

ORGANISATION/POPULATION SIZE:

Q.6. What is the size of your organisation or firm (how many persons employed)?

TABLE 4.21

SIZE CLASSIFICATION	ROW	FREQUENCY	PERCENTAGE
(a) One person	1	-	-
(b) 2-3 persons	2	1	1.35
(c) 4-7 persons	3	2	2.70
(d) 8-13 persons	4	-	-
(e) 14-24 persons	5	-	-
(f) 25-34 persons	6	1	1.35
(g) 35-59 persons	7	1	1.35
(h) 60-79 persons	8	1	1.35
(i) 80-114 persons	9	2	2.70
(j) 115-299 persons	10	11	14.86
(k) 300-599 persons	11	11	14.86
(l) 600-1,199 persons	12	18	24.32
(m) 1,200 and over	13	26	35.14
TOTAL	(N)	= 74	100%

TRADE UNION MEMBERSHIP

Q.7. Do you belong to any trade union?

TABLE 4.22

NO.	RESPONSE	FREQUENCY	PERCENTAGE
1	Yes	5	6.76
2	No	69	93.24
	TOTAL (N) =	74	100%

TRADE UNION TYPE

TABLE 4.23

NO	DESCRIPTION	FREQUENCY	PERCENTAGE
1	UCAAT	-	-
2	T&GWU	-	-
3	EEPTU	-	-
4	Others	5	6.76
5	None	69	93.24
	TOTAL (N) =	74	100%

MARITAL STATUS

TABLE 4.24

NO.	STATUS	FREQUENCY	PERCENTAGE
1	Married	60	81.08
2	Single	14	18.92
	TOTAL (N) =	74	100%

SEX

TABLE 4.25

NO.	TYPE	FREQUENCY	PERCENTAGE
1	Male	72	97.30
2	Female	2	2.70
	TOTAL (N)	= 74	100%

AGE

TABLE 4.26

NO.	CATEGORY	FREQUENCY	PERCENTAGE
1	Under 21 years	1	1.35
2	21-25 years	5	6.75
3	26-30 years	9	12.16
4	31-35 years	12	16.22
5	36-40 years	20	27.03
6	41-45 years	7	9.46
7	46-50 years	6	8.11
8	51 and over	14	18.92
	TOTAL (N)	= 74	100%

'SERVICE' TO COMPANY

TABLE 4.27

NO.	CATEGORY	FREQUENCY	PERCENTAGE
1	Under 1 year	7	9.46
2	1-5 years	26	35.14
3	6-10 years	13	17.57
4	11-15 years	10	13.51
5	16-20 years	5	6.76
6	21-25 years	2	2.70
7	26-30 years	2	2.70
8	31 and over	9	12.16
	TOTAL (N)	= 74	100%

'SERVICE' TO INDUSTRY

TABLE 4.28

NO.	CATEGORY	FREQUENCY	PERCENTAGE
1	Under 1 year	3	4.05
2	1-5 years	9	12.16
3	6-10 years	9	12.16
4	11-15 years	10	13.51
5	16-20 years	8	10.81
6	21-25 years	14	18.92
7	26-30 years	6	8.11
8	31 and over	15	20.27
	TOTAL (N) =	74	100%

PROFESSIONAL MEMBERSHIP

TABLE 4.29

NO.	RESPONSE	FREQUENCY	PERCENTAGE
1	Yes	29	39.19
2	No	45	60.81
	TOTAL (N) =	74	100%

PROFESSIONAL BODY

TABLE 4.30

Key: * Discounted (See Table 4.20)
**Inst. Occupational Safety & Health.

NO.	TYPE	FREQUENCY	PERCENTAGE
1	CIOB	20	27.03
2	Graduate	21*	-
3	MICE	-	-
4	MIStruct.E	-	-
5	Inst. of Petroleum Engr.	-	-
6	IOSH**	-	-
7	Others COND/C, HND/C, B.Tech	9	12.16
8	None	45	60.81
	TOTAL (N) =	74	100%

.4.3 **Results of Contract Management Responses**

Section 1: Historical/Biographical Factors : Sample Population (N=56)

Q.1 Firm:

TABLE 4.38

No	FIRM TYPE	FREQUENCY	SCORE %
1.	Main Contractor	42	75.00
2.	Sub-Contractor	3	5.36
3.	Local Authority etc	-	-
4.	Self Employed	-	-
5.	Management Contractor	11	19.64
6.	Others	-	-
	TOTAL N =	56	100.00%

Q.2 Contract:

TABLE 4.39

No	FIRM TYPE	FREQUENCY	SCORE %
1.	Main Contractor (Trad)	44	78.57
2.	Managing Contractor	11	19.64
3.	Project Manager	1	1.79
4.	Others	-	-
	TOTAL N =	56	100.00%

Q.3 Trade/Business:

TABLE 4.40

No	FIRM TYPE	FREQUENCY	SCORE %
1.	General Builders	9	16.07
2.	Building & Civil Engineering	39	69.64
3.	Civil Engineers only	4	7.14
7.	Roofers	1	1.79
10.	Demolition Contractors	1	1.79
20.	Suspended Ceiling Specialist	1	1.79
24.	Others (M&E)	1	1.79
	TOTAL N =	56	100.00%

Q.4 Status:

TABLE 4.41

No	JOB/POSITION	FREQUENCY	SCORE %
1.	Managing Director	2	3.57
2.	Contracts Director	5	8.93
3.	Contracts Manager	30	53.57
4.	Project Manager	9	16.07
5.	Other Categories	10	17.86
	TOTAL N =	56	100.00%

Q.5 Full/Part-time Position (site):

TABLE 4.42

No		FREQUENCY	SCORE %
1.	Full-time on site	17	32.69
2.	Part-time (multi-sites)	33	63.46
3.	Agency base	1	1.92
5.	Other arrangements	1	1.92
6.	Unclear (spoilt)	(4)	- ?
	TOTAL N =	56	100.00%

Q.6 Frequency:

TABLE 4.43

No	SITE VISITING FREQUENCY	FREQUENCY	SCORE %
1.	1-2 times per week	29	51.79
2.	3-5 times per week	6	10.71
3.	Fortnightly	4	7.14
4.	Other patterns	17	30.36
	TOTAL N =	56	100.00%

Q.7 Craft Background:

TABLE 4.44

No	TYPE	FREQUENCY	SCORE %
1.	Bricklayer	7	12.50
2.	Carpenter/Joiner	13	23.21
3.	Painter/Decorator	NIL	-
4.	Plasterer	NIL	-
5.	Roofer	1	1.79
6.	Scaffolder	NIL	-
7.	Plumber	NIL	-
8.	Electrician	1	1.79
9.	Plant Operator/Fitter	NIL	-
10.	General Labourer	NIL	-
11.	University Graduate	14	25.00
12.	Technical College	17	30.36
13.	Other category	3	5.36
	TOTAL N =	56	100.00%

Q 8 Organisation Population:

TABLE 4.45

No	POPULATION	FREQUENCY	SCORE %
1.	1-10 persons employed	1	1.79
2.	11-50 " "	2	3.57
3.	51-200 " "	5	8.93
4.	201-500 " "	11	19.64
5.	501-1000 " "	10	17.86
6.	1001 and above persons employed	22	39.28
7.	Other categories	5	8.93
	TOTAL N =	56	100.00%

Q.9 Union Membership:

TABLE 4.46

No	RESPONSE	FREQUENCY	SCORE %
1.	YES	1	1.79
2.	NO	55	98.21
	TOTAL N =	56	100.00%

Q.10 Marital Status:

TABLE 4.47

No	STATUS	FREQUENCY	SCORE %
1.	Married	43	76.79
2.	Single	13	23.21
	TOTAL N =	56	100.00%

Q.11 Sex :

TABLE 4.48

No	TYPE	FREQUENCY	SCORE %
1.	Male	53	94.64
2.	Female	3	5.36
	TOTAL N =	56	100.C0

Q.12 Age:

TABLE 4.49

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 21 years	7	12.50
2.	21 - 25 years	3	5.36
3.	26 - 30 years	1	1.79
4.	31 - 35 years	8	14.29
5.	36 - 40 years	9	16.07
6.	41 - 45 years	19	33.93
7.	46 - 50 years	4	7.14
8.	51 years and over	5	8.93
	TOTAL N =	56	100.00%

Q.13 Service to the Company:

TABLE 4.49(b)

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 1 year	5	8.93
2.	1 - 5 years	12	21.43
3.	6 - 10 years	11	19.64
4.	11 - 15 years	10	17.86
5.	16 - 20 years	5	8.93
6.	21 - 25 years	9	16.07
7.	26 - 30 years	3	5.36
8.	31 years and over	1	1.79
	TOTAL N =	56	100.00

Q. 14 Industry 'Service':

TABLE 4.50

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 1 year	4	7.14
2.	1 - 5 years	4	7.14
3.	6 - 10 years	3	5.36
4.	11 - 15 years	6	10.71
5.	16 - 20 years	15	26.79
6.	21 - 25 years	11	19.64
7.	26 - 30 years	10	17.86
8.	31 years and over	3	5.36
	TOTAL N =	56	100.00

Q.15 Membership of Professional Institutions:

TABLE 4.51

No	RESPONSE	FREQUENCY	Score %
1.	YES	29	51.79
2.	NO	27	48.21
	TOTAL N =	56	100.00%

Q.16 Professional Institute:

TABLE 4.52

No	INSTITUTION	FREQUENCY	SCORE %
1.	CIOB	15	26.79
2.	IOSH	-	-
3.	ICE	5	8.93
4.	MIRISK etc	-	-
5.	Others (including RICS etc)	9	16.07
6.	None	27	48.21
	TOTAL N =	56	100.00%

Q.17 Any Technical Achievements :

TABLE 4.53

No	RESPONSE	FREQUENCY	SCORE %
1.	YES	45	80.36
2.	NO	11	19.54
	TOTAL N =	56	100.00%

Q.18 Qualifications:

TABLE 4.54

No	TYPE	FREQUENCY	SCORE %
1.	City and Guilds	10	17.86
2.	OND/ONC	9	16.07
3.	HND/HNC	22	39.29
4.	BTEC	1	1.79
5.	Degree (BSc etc)	7	12.50
6.	Post Graduate (MSc etc)	-	-
7.	Others	7	12.50
8.	Doctorate (Phd)	-	-
	TOTAL N =	56	100.00%

Q.19 Was Safety Taught as Subject:

TABLE 4.55

No	RESPONSE	FREQUENCY	SCORE %
1.	YES	22	39.29
2.	NO	44	60.71

ANALYSIS AND CLASSIFICATION OF SAFETY ADVISERS/OFFICERS etc RESPONSES

Section 1: Historical/Biographical Factors : Sample Population (N=55)

Q 1 Firm:

TABLE 4.63

No	FIRM TYPE	FREQUENCY	SCORE %
1.	Main Contractor	37	67.27
2.	Sub-contractor	6	10.91
3.	Local Authority etc	1	1.82
4.	Self-employed	5	9.09
5.	Management Contractor	5	9.09
6.	Others	1	1.82
	TOTAL N =	55	100.00%

Q.2 Contract:

TABLE 4.65

No	FIRM TYPE	FREQUENCY	SCORE %
1.	Main Contractor (traditional)	41	74.55
2.	Management Contracting	8	14.55
3.	Project Management	-	-
4.	Others	6	10.90
	TOTAL N =	55	100.00%

Q.3 Trade/Business:

TABLE 4.65

No	FIRM TYPE	FREQUENCY	SCORE %
1.	General Builders	7	12.73
2.	Building & Civil Engineering	37	67.27
3.	Civil Engineering	1	1.82
8.	Plasterers	1	1.82
11.	Scaffolding	2	3.64
18.	Construction Engineers	1	1.82
22.	Ground workers	1	1.82
23.	Others	5	9.09
	TOTAL N =	55	100.00%

Q.4 Status :

TABLE 4.66

No	JOB/POSITION	FREQUENCY	SCORE %
1.	Chief Group Safety Adviser	12	21.82
2.	Safety Adviser	28	50.91
3.	Safety Officer	11	20.00
4.	Safety Engineer	1	1.82
5.	Others	3	5.45
	TOTAL = N	55	100.00%

Q.5 Craft Background:

TABLE 4.67

No	TYPE	FREQUENCY	SCORE %
1.	Bricklayer	4	7.27
2.	Carpenter & Joiner	12	21.82
3.	Painter/Decorator	-	-
4.	Plasterer	1	1.82
5.	Roofer	-	-
6.	Scaffolder	4	7.27
7.	Plumber	-	-
8.	Electrician	1	1.82
9.	Plant operator/fitter	3	5.45
10.	General labourer	-	-
11.	University Graduate	1	1.82
12.	Technical College educated	5	9.09
13.	Others	24	43.64
	TOTAL = N	55	100.00%

Q.6 Population :

TABLE 4.68

No	ORGANISATION SIZE	FREQUENCY	SCORE %
1.	1 - 10 persons	6	10.91
2.	11 - 50 "	-	-
3.	51 - 200 "	4	7.27
4.	201 - 500 "	7	12.73
5.	501 - 1000 "	4	7.27
6.	1001 and above	34	61.82
	TOTAL = N	55	100.00%

Q.7 Union Membership:

TABLE 4.69

No	RESPONSES	FREQUENCY	SCORE %
1.	Yes	NIL	-
2.	No	55	100.00%
	TOTAL N =	55	100.00%

Q.8 T.U. Type:

TABLE 4.70

No	TYPE	FREQUENCY	SCORE %
1.	Void	-	-
2.	NIL	55	100.00%
	TOTAL N =	55	100.00%

Q.9 Marital Status :

TABLE 4.71

No	STATUS	FREQUENCY	SCORE %
1.	Married	48	87.27
2.	Single	7	12.73
	TOTAL N =	55	100.00%

Q.10 Sex :

TABLE 4.72

No	TYPE	FREQUENCY	SCORE %
1.	Male	54	98.18
2.	Female	1	1.82
	TOTAL N =	55	100.00%

Q.11 Age :

TABLE 4.73

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 21 years	3	5.45
2.	21 - 25 years	-	-
3.	26 - 30 "	2	3.64
4.	31 - 35 "	3	5.45
5.	36 - 40 "	6	10.91
6.	41 - 45 "	8	14.55
7.	46 - 50 "	8	14.55
8.	51 years and over	25	45.45
	TOTAL N =	55	100.00%

Q.12 Service to Company :

TABLE 4.74

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 1 year	7	12.73
2.	1 - 5 years	12	21.82
3.	6 - 10 "	8	14.55
4.	11 - 15 "	7	12.73
5.	16 - 20 "	7	12.73
6.	21 - 25 "	5	9.09
7.	26 - 30 "	3	5.45
8.	31 years and over	6	10.91
	TOTAL N =	55	100.00%

Q.13 Service to Industry :

TABLE 4.75

No	CATEGORY	FREQUENCY	SCORE %
1.	Under 1 year	1	1.82
2.	1 - 5 years	3	5.45
3.	6 - 10 "	7	12.73
4.	11 - 15 "	6	10.91
5.	16 - 20 "	9	16.36
6.	21 - 25 "	8	14.55
7.	26 - 30 "	5	9.09
8.	31 years and over	16	29.09
	TOTAL N =	55	100.00%

Q.14 Professional Membership:

TABLE 4.76

No	RESPONSE	FREQUENCY	SCORE %
1.	Yes	55	100.00
2.	No	-	-
	TOTAL N =	55	100.00%

Q.15 Professional Institute Membership :

TABLE 4.77

No	INSTITUTION	FREQUENCY	SCORE %
1.	CIOB	18	32.73
2.	IOSH	30	54.55
3.	Degree	-	-
4.	MIIRISK etc	4	7.27
5.	ICE	1	1.82
6.	Others	2	3.64
	TOTAL N =	55	100.00%