The usefulness of Critical Incident Technique (CIT) in eliciting plant competencies

A Pilot Study

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The Health and Safety Laboratory (HSL) conducted the research on which the present report is based for the Health and Safety Executive (HSE). The research was contracted to examine the relationship between competencies and the reasons for accidents and incidents involving construction plant operators. The present research is the Pilot Phase of the project and is meant to establish the efficacy of a critical incident technique method.

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EXECUTIVE SUMMARY

Purpose
To establish the efficacy of the critical incident technique (CIT) method, for the purpose of examining the relationship between competencies\(^1\) and the reasons for accidents and incidents involving construction plant operators.

Objectives
- To pilot the use of critical incident technique with a selected sample of plant operators in the construction industry.
- To pilot the analytical procedures to be used in the interpretation of the data.
- To produce a report with recommendations as to how to use this methodology.

To date, research has identified that issues of competence lie behind accidents/ill health in construction industry plant operatives (e.g. Choudhry and Fang, 2008). However, other factors may also be involved. The extent to which competence, or the lack of it, is responsible for accidents/ill health is not clear. Little is known of the exact nature of these issues since much of the evidence tends to be quantitative material, which gives limited information. In order to explore these issues, a qualitative approach is proposed as it is the research methodology that can generate richness of information in context.

The critical incident technique is qualitative in nature and thus provides a possible method to provide the quality of information necessary to understand the relationship between competencies and accidents/ill health. This pilot study will attempt to establish the efficacy of this method in determining this relationship for construction plant operators. The work is conducted in partnership with two other organisations, the Noordwijk Risk Initiative (NRI) Foundation, and ConstructionSkills.

Methodology
Using the critical incident technique, this pilot study concentrated on plant operators in two categories; excavators and dumpers. These machines have been identified as plant that is most commonly used and which attract a high level of accidents. The preferred method for this study was qualitative, based on interviewing. All interviews were audio recorded. The resulting data were subjected to content and thematic analysis.

Results
Two main learning points emerged from the pilot that illustrate the efficacy of critical incident technique for this type of work and working in partnership with external organizations. Firstly, the small numbers involved in the pilot mean that the data cannot be considered robust enough to draw firm conclusions. Secondly, indications are that there is a complex interaction of both technical and interpersonal skills that operate to help reduce/prevent accidents on construction sites.

Overall, the eighteen interviews yielded the following:
- Thirty-two critical incidents were identified from 15 interviews.

\(^1\) Competencies refer to both the behaviours and the minimum standard required to function effectively (Hogg, 2008)
• Only one of the 18 interviewees had personally witnessed a fatality; that was 20 years ago.
• Two interviewees gave third party accounts of a fatality.
• The interviewees gave accounts of 16 accidents.
• The interviewees gave accounts of 16 near misses.
• The interviewees were involved personally in 16 of the 32 critical incidents.

**Recommendations**

The following recommendations are proposed to move the research forward:

1) Critical incident technique is a valid tool for this work, as it can capture detailed information about incidents, and could be used in any further studies. However, it is essential that any interviewer who is involved in the process is aware of the nature of the technique and how to proceed.

2) Discussions should be held with ConstructionSkills, especially in respect of the Construction Plant Competence Scheme (CPCS) to gather data in respect of existing and new competencies that could be incorporated into any future studies.

3) There is a need to progress with this work in the construction industry to build on those competencies that the literature has shown is relevant, and that needs to be explored further. The competencies outlined from the present research, is one step in that direction.

4) Any future work needs to be clearly defined, especially in terms of the recruitment of the participants, such as determining if they have experienced an incident. Further, they must be comfortable to disclose information.

5) Boundaries about the research process need to be established from the outset. The HSL and the HSE need to firm up working relations with external partners so clear expectations and roles are put in place from the outset.

6) Due to the possibility that flashbacks may occur when the participants are recalling the incidents, it is essential that the appropriate ethical issues are addressed.
1 INTRODUCTION

The Health & Safety Laboratory (HSL) conducted the research on which the present report is based for the Health & Safety Executive (HSE). The research was contracted to examine the relationship between competencies and the reasons for accidents and incidents involving construction plant operators. The present research is the Pilot Phase of the project and is meant to establish the efficacy of a critical incident technique method.

1.1 PURPOSE

The main purpose of the research is to establish the efficacy of the critical incident technique method for the purpose of examining the relationship between competencies and the reasons for accidents and incidents, involving construction plant operators.

1.2 OBJECTIVES

The project involves three objectives:

- To pilot the use of critical incident technique with a selected sample of plant operators in the construction industry.
- To pilot the analytical procedures to be used in the interpretation of the data.
- To produce a report with recommendations as to how to use this method.

1.3 BACKGROUND

The revision of the Construction (Design and Management) (CDM) Regulations in 2007\(^2\) has raised the significance of competence as a factor in preventing accidents. The revised CDM Approved Code of Practice (ACOP) uses the National Vocational Qualifications (NVQ) as a standard benchmark for competence. There is very little detailed research that seeks to establish whether or not the NVQ qualification is effective in assuring health and safety standards and which elements of the NVQ programme are safety critical. There are currently 74,000 operatives in the Construction Plant Competence Scheme (CPCS)\(^3\) who will be required to be NVQ qualified in the next three years. This figure is unlikely to be achieved unless new ways of assessing competence are established that can improve on the current NVQ framework.

The CPCS is a card scheme to improve the skills of plant operators. It is based on a combination of professional competence and health and safety awareness - two essential qualities for operating plant. More than 150,000 individuals carry the card, and it is required to be able to operate most categories of plant on MCG (Major Contractors Group), NCF (National Contractors Federation) and the National House-Building Council (NHBC) sites. It is the main standard for plant operators, with ConstructionSkills (the Sector Skills Council for Construction) responsible for its administration.

ConstructionSkills employs monitors for the purpose of carrying out inspections on behalf of the scheme. This ensures that the CPCS’s policies and standards are maintained and the training providers comply with their conditions of registration. The CPCS monitors work in area teams and have a designated sector. Any concerns regarding the standards of training, assessments or tests relating to CPCS are reported to appropriate CPCS monitors.

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\(^2\) See http://www.hse.gov.uk/construction/cdm.htm

\(^3\) See http://www.citb.org.uk/cardschemes/whatcardschemesareavailable/cpcs/index.asp
To date, research has identified that issues of competence lie behind accidents/ill health in construction industry plant operatives (e.g. Choudhry and Fang, 2008). However, other factors may also be involved. The extent to which competence, or the lack of it, is responsible for accidents/ill health is not clear. Little is known of the exact nature of these issues since much of the evidence tends to be quantitative material, which gives limited information. In order to explore these issues, a qualitative approach is preferred, since this is the research method that can generate richness of information in context.

The Critical Incident Technique (CIT) is a qualitative process and provides a possible method to provide the quality of information necessary to understand the relationship between competencies and accidents/ill health. This pilot study will attempt to establish the efficacy of this method in determining this relationship for construction plant operators.

To assist with this project, the Noordwijk Risk Initiative (NRI) Foundation, a not for profit organisation, is to bring its expertise in developing methodologies and tools for workplace safety to this project. ConstructionSkills is committed also to this study, as little work has been done on the relationship between safety and competence. The involvement of these two organisations with HSE and HSL should provide an opportunity to assess the effectiveness of this partnership and capture lessons for future collaborations with external groups.
An initial literature search was carried out in respect of accidents with construction plant. The search returned 114 references from Oshrom and 19 references from Healsafe and Ergonomics abstracts. From these 133 references, 14 relevant papers were requested, of which 11 were received. Further inspection of the papers led to the following review of the specific literature on accidents involving dumpers and excavators in the construction industry. The literature reveals a number of common factors associated with accidents involving dumpers and excavators and the main causations for these.

Research conducted by the Health & Safety Executive (Male and Corbridge, 2001) considered the safety of construction transport, in a survey of standards of accidents associated with construction machinery. The report describes the root causes of common accidents and technical factors involved in transport and mobile work equipment accidents. It covers accidents reported to the HSE involving vehicles on construction sites (1994/95 to 1998/99), investigated by HSE inspectors involving earth-moving machinery (1986/87 to 1995/96) and investigated by HSE inspectors involving vehicles on construction sites (1994/95 to 1998/99).

In terms of accidents reported to HSE (1994/95 to 1998/99), dumpers and excavators were involved in 35 per cent of fatal, 51 per cent of major and 51 per cent of over 3-day reported accidents. Of the accidents reported to HSE (1994/95 to 1998/99), dumpers and excavators were involved in 73 per cent of vehicle accidents where technical factors could have been involved in or affected the outcome of the accident.

Detailed analysis of earth moving machinery accidents investigated by HSE inspectors (1986/87 to 1995/96) was considered also as part of that study (Male and Corbridge, 2001). For dumpers/dump trucks, 179 accidents were assessed, of these 77 per cent occurred when dumpers/dump trucks were travelling forward or while they were stationary. Eighty-three accidents were attributed to dumpers/dump trucks being knocked into gear while stationary with the engine running, 82 per cent of which involved dumpers. Furthermore 30 accidents occurred when dumpers/dump trucks were started while in gear, 23 of which occurred as a result of people starting the vehicle while standing next to it. For excavators/backhoes, 486 accidents were assessed. Thirty-nine accidents occurred when people were hit by slewing excavators and 17 accidents occurred when the buckets of working excavators struck people. Accidental contact with controls accounted for 20 accidents, and a further five accidents were ascribed to errors in the use of controls.

Overall, the findings from the quoted report were based on an analysis of accidents reported to HSE and investigated by HSE inspectors, it is argued that most types of serious accidents were covered in the report, and the data are a good indicator of the common factors which contribute to the most serious and frequent accidents.

To summarise the main findings from this report, dumpers and excavators were involved in the majority of construction vehicle accidents. Reversing vehicles were a common reason for accidents, and pedestrians in a significant number of accidents, including excavators and dump trucks, sustained fatal or major injuries. A common reason for accidents on dumpers and excavators were falls from vehicles when alighting or gaining access to operator stations and other parts.

Further research prepared by BOMEL Ltd. for the HSE (2004) considered the underlying causes and risk control for construction transport accidents. The analysis of the Specialist Inspector Report on data for 58 accidents showed that over the 10-year period from April 1986, dumpers
and excavators were shown to be the main source of accidents. They were also likely to have been the most frequently used plant. The primary reasons for fatal injury accidents involved being struck by moving plant; by the loss of control; and by not being able to sustain stability on slopes. The largest numbers of injuries were due to being struck by plant with the second largest number being plant knocked into gear whilst stationary with its engine running.

For dumpers, most fatalities were associated with them losing control on slopes, either due to loss of stability, or the dumper moving away rapidly whilst on a slope. The second largest source of accidents was injuries to persons standing next to the dumper when it was started in gear. For excavators the main reasons for concern were related to people being struck by cabs, counterweights or backhoes when the excavator was slewing. A further significant issue was accidental operation of the controls, with contact being made when getting in or out, during operation due to operator error.

The research showed also that the top factor in terms of management factors in construction transport accidents was when more than one employer was involved. This suggests unclear responsibilities for safety. Further shortcomings of management were failure to deal with unsafe behaviour, communication breakdowns, inadequate risk assessments and failure to monitor standards. The main issues with regard to vehicle factors were suitability and stability of the vehicle and all round visibility. In terms of suitability and stability, inappropriate selection and use of the vehicle were the main influences as opposed to any hardware issues. For visibility, inadequate design was thought to be the cause.

The main behavioural factors included driving without due care and attention, not following established systems of work and the selection of inappropriate routes. The report revealed that in the majority of cases the problem seemed to stem from violation of known rules more than a lack of knowledge.

Overall the main findings from this report showed that the main types of plant of concern were dumpers, excavators and dump trucks. The main causes of accidents involved striking pedestrians during the work process and accidental operation of the controls, particularly the gears.

Research by Edwards (2003) considered accident trends involving construction plant operating within the UK construction industry over the past decade (1989 to 1999). An analysis of health and safety statistics revealed that subcontractors are four times less likely to sustain injury than construction employees. Furthermore, they revealed that accidents for moving vehicles account for more major and fatal accidents than contact with machinery. Despite recent plant legislation, such as the Provision and Use of Work Equipment Regulations (PUWER) and the Safe Use of Lifting Equipment (Lifting Operations and Lifting Equipment Regulations 1998 - LOLER 98), plant-related accident rates remained largely unchanged. Edwards (2003) hypothesises possible reasons for this, including, a lack of satisfactory practitioner understanding of plant legislation as well as a failure by the industry to impose mandatory plant operator training certification. However, further research would be required to conclude such hypothesis.

A study by McCann (2006) investigated heavy equipment and truck-related deaths on excavation work sites. The researcher looked at the Consensus of Fatal Occupational Injuries data, which identified 481 deaths in the excavation work industry from 1992-2002, and of which 253 deaths were caused by vehicles. The findings from the research showed that 63 per cent of deaths of operators who were struck by vehicles involved an operator falling or jumping from the vehicle and then being run over by it. All of the operators on foot that were struck were run over by their own vehicle, due to it being in gear or from failure to set the brakes.
The overall findings of the study showed that the main causes of deaths of operators on foot and of workers maintaining vehicles were failure to set brakes, leaving vehicles in gear, or other failures to lock out vehicles when getting out of them or working around them.

Recent research carried out by Loo-Morrey, Scott and Stilton (2006) analysed the reporting of injuries, diseases and dangerous occurrences regulations (RIDDOR) data for 75 fatal accidents (1996 - 2006) involving slow moving vehicles and pedestrians, the aim of which was to generate an initial indicator of accident causation. The researchers found that large goods vehicles and heavy plant were most commonly involved in fatal accidents, with heavy plant accounting for 33 per cent of accidents. However, heavy plant was not broken down into individual pieces of plant for this report, so it is not possible to comment on dumpers and excavators specifically. Most of the fatalities resulted in the person being struck by the vehicle, and the most common activity being carried out at the time of the accidents was reversing. Overall the report found that systems of work failures were identified in 59 per cent of the cases that were examined; with the most commonly identified shortcoming being a lack of safe systems of work.

**Overview**

Overall, the literature indicates that dumpers and excavators are involved in the majority of construction transport accidents, and, therefore, appear to be the main types of plant for concern. There are a number of common factors relating to accidents involving dumpers and excavators. Almost all of the literature demonstrates that the reversing of vehicles is a common reason for accidents, as well as accidental operation of controls. This includes starting vehicles whilst in gear, knocking the vehicle into gear when the engine is running and contact being made with the controls when getting in and out of the vehicle. For excavators, a reason for accidents also seems to be related to people being struck by cabs, counterweights and backhoes when the excavator is slewing.

It is recognised in the literature that systems of work failures are related to accidents involving dumpers and excavators, indicating that not following the established systems of work and a lack of safe systems of work are the main behavioural factors involved. Research by Edwards (2003) also suggests a possible lack of understanding of the legislation or a failure by the industry to impose mandatory operator certification.
3 METHOD

This pilot study used the critical incident technique to assess plant operators who handle machines in two categories: dumpers and excavators. These have been identified as plant that is most commonly used and which attract a high level of accidents. The preferred method for this study was qualitative, based on interviewing.

3.1 GAINING ACCESS TO THE SITES

The access to the construction sites was reliant on the co-operation of ConstructionSkills. The monitors employed by ConstructionSkills liaised with site managers from five sites around the country (Dartford, Dobwells, London, Newport, Wales and Sheffield) to provide access to the research team and make available four volunteers per site for interviewing.

Appendix I shows the brief that was given to the managers of the sites about the present study.

3.2 SAMPLE SIZE

The qualitative interview method dictates that interviews continue until there is no new information being gathered (Moser and Kaltman 1979). This ensures that the data obtained are meaningful, robust and generalisable. Once the information is analysed, the key stakeholders decide if there are any gaps in the information obtained and/or if the information obtained, points to the need for further enquiry (Robson, 2002). In the opinion of the research team (based on past experience), a sample size of ten for each piece of plant should suffice for this stage of the work in order to identify issues relating to the method. The sample was drawn from large ‘prestigious’ sites and smaller construction sites. The logic of this was to encompass both ends of the industry, major players and smaller companies.

3.3 THE PARTICIPANTS

A brief look at the literature indicated that the age of workers was not a factor in accident causation; however, tenure was a factor. Therefore, at each site the participants consisted of the following:

- One operator with less than one year’s experience.
- One operator with greater than one but less than five years’ experience.
- One operator with greater than five but less than ten years’ experience.
- One operator with over ten years’ experience.

All participants were volunteers but were identified by the site manager.

Although it was intended originally to interview five operators per site on the days of the interviews, two individuals who were selected by their managers did not meet the criteria set by the researchers and were not included in the sample. In total, eighteen individual interviews with
plant operators (nine dumper drivers and nine excavator drivers) were conducted from the five sites.

Incentives in the form of gift vouchers were offered to participants for participating in the research.

3.4 THE CRITICAL INCIDENT TECHNIQUE (CIT)

Developed by Flanagan (1954), the CIT is an open-ended retrospective method of finding out what people feel are the critical features of the phenomena being evaluated. It focuses on individual behaviour, so it can be used in situations where video recording is not practicable so long as the inherent bias of retrospective judgement is understood. The CIT is a method for getting a subjective report while minimising interference from stereotypical reactions or received opinions. The user is asked to focus on one or more critical incidents, which s/he experienced personally in the field of activity being analysed. For clarification, a critical incident is defined as one that had an important effect on the final outcome of an event. Critical incidents can only be recognised retrospectively.

The process involves interviewees being asked to identify specific incidents which they experienced personally and which had an important effect on the final outcome of the situation. The emphasis is on incidents rather than vague opinions. The user is requested to:

- Focus on an incident which had a strong positive/negative influence.
- Focus on the result of their actions and describe the incident.
- Describe what led up to the incident.
- Describe how the incident helped them succeed in other incidents.

It is usual to request two or maybe three such incidents, but at least one should be elicited. When the first one has been obtained, the procedure is repeated. Following the above formula the interviewee is asked to place the incidents listed in context of importance. There will be some variation in the number of positive and negative incidents interviewees are able to recall.

It is also usual to start with a positive incident in order to set a constructive tone with the individual. If context is well understood, or time is short, the method may be stripped down and the individual simply required to do the first part only, e.g., focus on describing the positive and negative critical incidents.

In an interview situation, the interviewees can be re-directed if they attempt to reply with generalities, e.g., not tying themselves to a specific incident.

For the purposes of the present study, the research team agreed an operational definition of a critical incident is as follows: ‘a personally observed discrete piece of behaviour where the cause and effect is clear for the respondent and significant to the individual’.
3.5 THE INTERVIEW SCHEDULE

The interview schedule was very detailed in order to provide a background and context of the process for the interviewees. This schedule was agreed between the HSE, NRI and the HSL prior to interviewing taking place to ensure it met the aims of the work. The schedule is provided at Appendix II.

3.6 THE INTERVIEWS

All of the interviews were face-to-face and audio recorded. At the start of each interview, the participants were informed of the study, its objectives and the confidential nature of the interview. The researcher recorded the interviews to ensure that all the information was collected verbatim. The respondents were given the option of not having their interviews recorded, but they all agreed to the process.

The researcher outlined the process to the interviewees, asked them to describe an incident and allowed them to speak about any incidents or other work-related issues but did pursue any interesting views that arose. Although not all of the interviewees had experienced personally an incident, they were allowed still to provide any information in respect of incidents on site to ensure that they highlighted any relevant competencies.

The interviews lasted between 20-60 minutes, at the end of which, the participants were thanked for their time and offered the opportunity to ask any questions.

At each interview, a HSL interviewer and a subject matter expert (SME), the monitor, was present. The role of the HSL interviewer was to facilitate the interview using CIT. The role of the monitor was to both observe and ask critical questions relating to the information being given by the interviewee in respect to training and competence. ConstructionSkills identified the monitor who was knowledgeable in the competencies required by plant operators for NVQ accreditation. During the interview, the monitor was to identify those NVQ competencies that address safety critical behaviours associated with the safety issues raised by the interviewees. They were also to identify gaps (where they existed) in safety critical behaviours not covered by existing NVQ competencies. They were then to report their findings to the research team for collation.

3.6.1 The Analysis

The taped interview data were transcribed verbatim, and the transcripts were sent to the interviewees for them to confirm that the information was accurate. However, only two transcripts with amendments were received from the participants. The other participants did not contact the researchers in respect of their interviews. Once the necessary amendments, as highlighted by the participants were completed, the researchers proceeded to analyse the data.

Due to the nature of the data, the analysis was completed in two phases. The first phase was to identify the critical incidents that were described by the participants. Additionally, although the participants highlighted some specific critical incidents, other critical incidents emerged during the interpretation of the data (emergent themes). The transcripts were read carefully to identify critical incidents, and these were classified by location or other useful characterising data, and aggregated into related categories. As such the analysis encompasses the key steps outlined by Flanagan (1964; selecting a general frame of reference, formulating tentative headings, sorting incidents into areas while formulating new categories and sub-categories as necessary, defining the categories and refining as necessary).
Each critical incident was then re-transcribed to a pro forma (see an example at Appendix III). The themes were then put into categories. Discussions then took place separately with the HSE and the NRI to validate the findings and the method used. From the discussion with the HSE a hypothetical competence framework arose that allowed the mapping of the emergent factors from the analysis (as shown in Figure 1 for the incidents cited by the interviewees). This Framework promotes competence along three dimensions: basic knowledge of health and safety, relational skills and occupational skills. These competencies are supported by the literature (see Aksorn and Hadikusumo, 2008; Choudhry and Fang, 2008; Dingsdag, Biggs and Sheahan, 2008) as they are based on ones that have been shown to be relevant to the construction industry. They provide a starting point to the structuring of a model that can be built on and developed further by future research.

Once the critical incidents were identified, the researchers commenced the second phase, which involved conducting a thematic analysis on the data. This type of analysis is useful to explore the ‘richness’ of the data (Hayes, 2000). An inductive approach was used to allow themes to emerge from the data (Patton, 1990). A process of constant comparison, among the responses to the questions and among interviews, elicited all of the overarching themes. This is important as Hayes (2000) recommends that it is necessary to ensure that all themes are accounted for in each interview. So, for example, if a new theme arose in transcript seven, then transcripts one to six would be read again to ensure that the theme was captured from all of the transcripts. Once all of the transcripts were assessed they were assessed again to ensure that the researchers accounted for all of the main themes and any subsequent sub-themes from all of the transcripts.
4 RESULTS

4.1 CRITICAL INCIDENTS

In total, five construction sites were used ranging from large ‘prestigious’ construction projects to residential building sites. The eighteen interviews were analysed manually by two psychologists, screening the text and identifying possible critical incidents (see Patterson, Ferguson, Lane, Farrell, Martlew and Wells, 2000). Appendix III provides an illustrated example of the criteria used in identifying the critical incidents, as outlined:

1. Critical incident number (unique identifier)
2. Experience (personal or other party)
3. Characteristics of interviewee (e.g. age, gender, education experience)
4. Vehicle type (dumper or excavator)
5. Descriptive account of site operations where incident occurred (e.g. large scale house building, small scale demolition)
6. Outcome positive (something that went well) or negative (something that went wrong)
7. Accident or near miss
8. Summary of incident
9. Critical environmental factors
10. Critical behaviours
11. Critical behaviour of others
12. Any other indirect factors.

The eighteen interviews yielded the following:

- Thirty-two critical incidents were identified from 15 interviews.
- Only one of the 18 interviewees had personally witnessed a fatality; that was 20 years ago.
- Two interviewees gave third party accounts of a fatality.
- The interviewees gave accounts of 16 accidents.
- The interviewees gave accounts of 16 near misses.
- The interviewees were involved personally in 16 of the 32 critical incidents.
The incidents were categorised into three categories that comprise a competency framework, inclusive of occupational skills, basic knowledge of health & safety and relational skills. See Figure 1.

**Figure 1:** Incidents cited by interviewees in relation to the 3-dimensional model

As outlined previously, the categories or competencies were developed based on competencies that have been identified in the literature as relevant to the construction industry (Aksorn and Hadikusumo, 2008; Choudhry and Fang, 2008; Dingsdag *et al.*, 2008). The competencies consisted of behaviours as described:

1. Basic Knowledge of Health and Safety
   - Site worker walked into signed exclusion zone
   - Ground worker using mobile phone and not aware of surroundings
   - Site worker walked into bucket - blind spot

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4 A competency framework consists mainly of behavioural elements of competencies, but can include technical competencies, all of which must be measurable (Hogg, 2008)

5 “Competency’ is the behaviours that employees must have, or must acquire, to input into a situation in order to achieve high levels of performance, while ‘competence’ relates to a system of minimum standards or is demonstrated by performance and outputs” (Hogg, 2008)
• Engineer came “zipping out” (car)
• Engineer sat down in front of blade

2. Occupational Skills
• 4 × dumper overturn downhill, 2 × gears lost
• 2 × dumper collisions, due to “bad behaviour”
• 2 × lifting operations
• 1 × quick hitch problem
• 2 problems with muddy boots
• 1 positive example of use of mirrors

3. Relational Skills
• Dumper/excavator driver communications
• Driver refused order to lift, sent home
• Effective use of banksmen, observers
• Crane supervisor ignored by site manager
• Language comprehension
• Failure to listen to instructions

The critical incidents also identified other influencing factors that collated into 11 categories. See Appendix IV.

These factors showed that the most common factor was poor procedures/practices or procedures not followed ($n = 15$ instances of this occurring), followed by unsafe/poor driving ($n = 12$) and lack of awareness of other site workers (i.e. not including plant operators) ($n = 8$).

4.2 THE MAIN ISSUES TO EMERGE FROM THE DATA

Due to the richness of the data that emerged from the interviews, it was decided to capture this information in order that key concerns could be highlighted. A thematic analysis was used to extract the outcomes and the results are presented in Appendix V.

Although these data will not form a major part of the discussion in the present report, they do support the competency framework’s core dimensions of occupational skills (e.g. application of knowledge), basic knowledge of health & safety (e.g. elements of safety) and relational skills (e.g. communication), as outlined in Figure 1.
5 DISCUSSION

Based on the agreed success criteria, this pilot has been successful. In being successful, it has raised issues relating to both the method used and working with external partners. These issues can themselves be subdivided further. It has also produced options as to how the work can be taken forward. The discussion will look at each of these issues separately as well as the tentative findings from the interview analysis.

5.1 METHOD

5.1.1 Critical Incident Technique

The nature of this technique means that it is best used shortly after an incident has taken place, so that it draws out recent events for individuals after giving them time to reflect on those events. Critical incidents are pertinent only to the individual after reflection. As a means of gaining information on accident causation, it remains an ideal tool. Half of the critical incidents identified by participants were observed first hand (some many years previously). Many of the participants however had only second or third hand examples to give. Although, in its pure form, critical incident technique only allows for first hand examples to be used, a large amount of data was gathered by allowing the participant to recount second and third hand events. This was because it became apparent to the interviewers that the approach the participants took to the health and safety aspects of their work was based on the learning they had received through these events being recounted to them. As such, this information was pertinent to the study. Other information obtained by the interviewers was based on individual perceptions of working on building sites and on the training they had received, again, all of which were pertinent to the study. To have just concentrated on critical incidents would have meant valuable data would have been lost. Critical incident technique still remains a valid starting point for any future work relating to accident causation. To ensure information is gained from a wide spectrum of (in this case) plant operators, some of whom may have only limited experience of construction site accidents a broader definition of a critical incident may be necessary. This approach will also help to provide information on current issues, practices and training.

5.2 INTERVIEWING

It was felt by the HSL interviewers that more time was needed to settle the participants and that leading straight in with a question asking about critical incidents may have unsettled some of the participants. Critical incident technique follows an open-ended format, which gives participants time to think and reflect before they recount events. The interviewer intervenes only on occasions to elicit information through probes and only where necessary. This approach may have been novel to most participants and may have been disconcerting for some. The results however, would suggest that the majority of participants were not unduly concerned with this technique and in the majority of interviews a fluid conversation flowed, led by the interviewee.

The conditions in which the interviews took place were also not ideal, usually in huts set aside for administrative purposes. These were subject at times to people walking through and external noise from the site. Either of these may have made participants more reticent in recounting events due to the possibility of being overheard by management.
The presence of a CPCS monitor at each interview may also have made participants more reticent to recount events. Ideally, one to one person interviewing is preferred. At a number of interviews, two monitors were present with the interviewer. The monitors also tended to ask structured questions on issues, which resulted in many ‘yes’, ‘no’ answers being given. In addition, they were not familiar with the interviewing technique used, which relies on periods of silence to give the interviewee time to reflect before answering. This may have lead to them asking questions to alleviate what they may have perceived as embarrassing periods of silence. This in turn interrupted the flow of the interview.

Where the interviewee had little experience and was unable to provide examples of current experience, the skill of the interviewer facilitated the adaptation of the critical incident technique to enable more generalised comments to be elicited and so maximising data capture. This pragmatic approach was simply to let the interviews flow and, to encourage the interviewee to keep talking, with a minimum of structure imposed on the interview.

5.3 ANALYSIS PROTOCOL

The analysis outlined above was agreed to be the approach to adopt for future use. The researchers hoped to obtain the input of the participants by sending them a copy of the interview on which on to comment. Some of the participants, however, were reluctant to give their names and addresses. However, all of the participants were sent a copy of their respective interview through the various sites. Only two participants returned the interviews with marked amendments, and the researchers did not receive any form of communication from the others. The input from the participants therefore was minimal.

5.4 PARTICIPANTS

The site managers selected the participants. This was based on criteria the research team had supplied. It is known that in some cases, volunteers had been approached on the day of the interview. Ideally, access to the site a week or two earlier in order to promote the research, may have led to people coming forward and to self select. It would also have served to orientate participants to the interview technique to be used and the type of information for which the research team was looking. This may have also allowed for rapport to be built more readily.

5.5 DIGITAL RECORDERS AND TRANSCRIPTION

Digital recorders were used during the interview to maximise data capture. The participants did not object to this. The quality of the recordings was good. Due to the conditions in which the interview took place background noise interfered with the quality of some of the recordings. Another issue that arose with the recordings involved the dialects and accents. Whilst the monitors were able to decipher easily the ‘jargon’, the dialects and accents of some of the participants meant that some data were lost. Research in naturalistic surroundings will always be prone to data loss of this nature, making it challenging to achieve 100 per cent of the interview during the transcription process. Software programmes can eliminate a certain amount of background noise, but it is impossible to account for the myriad of possible accents to be found on a construction site. Due to the nature of the workforce such dialects and accents are more likely to be difficult to understand (Trudgill, 1983). The use of dedicated transcribers ensured that data capture was maximised. However, the use of note takers is unlikely to increase
data capture, as they will experience the same difficulties with accents and dialects as a transcriber (or risk interrupting the conversation flow to gain clarification). There was no issue with the quality of the digital recordings.

5.6 CONSTRUCTION SITE SUPERVISORS

The research team believes that to fully understand the issues and pressures on a construction site that affect health and safety, input from site supervisors and managers is essential. The issues affecting both employees and employers need to be fully integrated for a more meaningful analysis of accident causation and the link to competencies. The way to do this would be to attend the CPCS supervisors’ course and to run focus groups/interviews with supervisors. This was not possible to do because of time pressures for the present study but should be part of any future work.

5.7 PARTNERSHIP WORKING

Agreement was originally made with CPCS to involve their monitors and to gain access to sites. Operationally, this proved difficult. This was mainly due to the timescales the HSE had on the work and the operational availability of the monitors. The final decision on access to sites was also down to the site manager. This meant that a three-way liaison was necessary in order to gain access to construction sites. ‘Cold calling’ was not an option. This delayed the research team in completing the work. However, by goodwill and flexibility on all sides, the eighteen interviews were completed.

5.8 INVOLVEMENT OF THE CPCS MONITORS

The involvement of the CPCS monitors was important from a number of perspectives: One in gaining access to construction sites; two, in providing their technical expertise on issues; and three in helping to relate the findings to the CPCS’s NVQ accreditation system. It was not known to the research team that the monitors had their itineraries mapped out months in advance, nor were the monitors aware of their role in helping the research team gain access to construction sites. Because of their commitments, it was not possible to hold an initial induction with them in order to familiarise them with the objectives of the work and the techniques the researchers were going to use, before the onset of the interviews. As the techniques used in the interviews were unfamiliar to those not involved in psychology, professional counselling or any of the social sciences (and require skilled practitioners to fully utilize) the monitors may have felt uneasy when they where applied, e.g., the use of silence and long pauses.

Participating in the interviews, however, may not be the best way to utilise the monitors effectively. Consideration needs to be given to them forming part of the analysis team instead. This would bring their experience and expertise into ensuring that the analysis of the data is comprehensive and to ensure that findings are linked to CPCS competencies.
5.9 THE NOORDWIJK RISK INITIATIVE (NRI) FOUNDATION

The Noordwijk Risk Initiative (NRI) Foundation instigated the use of critical incident technique for this work and brought its expertise to the design of the method and to confirm the approach taken by HSL in the conduct of the research and its analysis. Issues of communication arose at times during this work, which may, in part, have stemmed from a lack of role and contractual clarity. These issues have now been resolved. The need for clear two-way communication and reporting lines through the project manager must be established at the outset of any future partnership working.

5.10 TAKING THE RESEARCH FORWARD

The results of this pilot would still point to critical incident technique as being valid as a starting point for future research in this field but it may need to be supplemented with a semi-structured questionnaire to ensure all pertinent data are captured.

Thought must also be given to dealing with individual cases where interviewees have ‘negative reactions’, e.g., flashbacks. This occurred during two interviews, one of which had to be terminated at the request of the interviewee (details of the interview to that point, were subsequently deleted). Feedback has been given to this individual and to his line management, to alert them to the possible significance of this for that individual. That interview was not included in the present dataset and the audio recording was erased. The other interviewee was happy to carry on and complete the interview. Both these incidents of flashback were related to fatalities. Critical incident interviewing is a powerful tool for recalling events and has the potential to bring traumatic events to the fore. This opens up the possibility that 10 per cent of any future construction industry sample may experience some negative reactions.

The possibility of flashbacks means that the HSE’s ethics committee must clear any future work proposal prior to the continued use of the critical incident technique. Should approval not be given, then another method to obtain data relating to plant operators competencies, directly from the construction sites would need to be designed. This could include producing a semi-structured questionnaire. Skilled interviewers will still be necessary to ensure that the technique adopted maximises the data yield.

The time scale of any future work must be negotiated with CPCS before the work is approved. This may mean that work has to be planned between six to 24 months in advance. This is to ensure that HSL, CPCS and construction site resources can be co-ordinated effectively and to induct CPCS monitors fully in the techniques to be used.

One option in accessing construction sites would be through HSE inspectors. This would still entail liaison and coordination. An issue here may be that the research team may be too closely linked with a regulating body. Another is that they may also be linked with specific incident investigation. However, either could bias the quality and quantity of information given by participants.

A further option would be to induct CPCS monitors in the interview technique and let them do further interviews. The interview technique employed in this work requires skilled practitioners. It is not an intuitive technique and requires a familiarity with psychological concepts. Training could be given but close monitoring and coaching would be needed over a timescale to ensure that the techniques were being employed effectively. The monitors would also need to feel comfortable with the interview style. The HSL would still be required to analyse the results.
5.11 INTERVIEW FINDINGS

Although the results must be treated with caution at this stage, they point to a complex relationship between skill and interpersonal relationships as being the main components in accident prevention on construction sites. It would appear also that as far as most plant operators are concerned that the training they receive does not equip them fully to operate on a construction site. Competence is only fully achieved after practise. Identifying competent personnel and learning from them is key to plant operators attaining full competence and in developing good health and safety practices. To some extent, the findings concur with the literature review, which indicates that not following known procedures and a lack of knowledge of the legislation as being causes of accidents. Continuation of the interviews is necessary in order to enlarge the database and provide more rigour to the findings so far. The importance of good supervision was identified also as a factor in accident causation.
6 CONCLUSIONS

The pilot has been successful in identifying issues relating to the method employed. More data are still required relating to skills and competencies of plant operators and their relation to accident prevention on construction sites. This work needs to be taken forward to gather the necessary data to inform CPCS and ConstructionSkills about developing their competency framework in order to reduce accidents on construction sites.

For the future phase of this work, the CPCS monitors could be trained to fulfill the roles of the judges/raters and thereby produce inter and intra reliability coefficients. Flanagan (1954) advocates the use of subject matter experts (or judges) to independently validate the critical incidents that are identified from the analysis of the interviews. In a review of 140 studies using CIT between 1975 and 2002, Grempler (2003) found that only nine per cent of judges in the studies had received training and that only 40 per cent were independent of the authors. Only five studies reported intra judge\(^6\) reliability whilst 55 per cent of the studies reported inter judge reliabilities.\(^7\) Training would need to continue until a Kappa value (or equivalent) of at least 0.9 is achieved for both inter and intra rater reliabilities (Kappa values of between 0.81 and 1.00 are considered to be very good, Altman, 1991). For this study, none of the monitors had any training in the analysis/recognition of critical incidents prior to them participating in the present research. The authors of the present study believe that the independence of the judges from the authors/researchers, adds reliability to the findings.

The CPCS monitors recognised the validity of the CIT approach and interview method but also criticised it. Although they felt that off site interviewing would be the best way forward, they also acknowledged that this was impractical and interviewing on site was the only option. They felt that an orientation visit by the research team a week or so beforehand, to recruit volunteers and orientate them to what was required, would help overcome issues of rapport building and help relax the volunteers. Another option would be to use ConstructionSkills events for interviewing and/or disseminating questionnaires. They also felt the use of questionnaires was a feasible option. This is a possibility in the future, once the research team is confident that it has gathered enough information to construct a meaningful questionnaire that addresses the research questions. However, care must be taken to ensure that the reading level of any question set takes into account the low literacy rates of employees in this industry as highlighted by some of the participants of the present research.

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\(^6\) The degree of consistency produced when data are rated under identical conditions by the same judge or rater

\(^7\) The degree of consistency obtained when different judges or raters independently rate results/data provided by the same individual
7 Recommendations on the Use of the Method for Future Studies

The CIT method has some advantages over other interviewing techniques as it allows for the gathering of first hand experiences of phenomena or behaviour. It can be used over a wide range of research situations. Although it is self-report data and there is a social desirability issue in self-report data, in that individuals may respond according to how they think they need to respond (Martocchio and O’Leary, 1989), it is sometimes the only way available for obtaining information on certain phenomena (Epstein, 1982; Turk and Kerns, 1985). Objective measures are not always possible in research situations, and certain types of information are sensitive and are needed directly from participants (Noor, 1995). However, like most techniques it has its advantages and disadvantages when used within a research process.

The Advantages

- The data are collected from the respondent’s perspective and in his or her own words.
- It does not force the respondents into any given framework, unlike other interviewing techniques, which may lead the individual into responding to questions based on the structure of those questions.
- It identifies even rare events that might be missed by other methods, which only focus on common and everyday events.
- It is useful when problems occur but the causes are not known.
- It is inexpensive and provides rich information.
- It emphasizes the features that will make a system particularly vulnerable and can bring major benefits (e.g. safety).
- It can be applied using questionnaires or interviews.

The Disadvantages

- The critical incident technique relies on events being remembered by users and also requires the accurate and truthful reporting of them.
- As critical incidents rely on memory, incidents may be imprecise or may even go unreported.
- The method has a built-in bias towards incidents that happened recently, since these are easier to recall.  

[8] This is known as the recency effect. This is the principle that the most recently presented items or experiences will most likely be remembered best. If you hear a long list of words, it is more likely that you will remember the words you heard last (at the end of the list) than words that occurred in the middle (Deese and Kaufman, 1957)
• Respondents may not be accustomed to or willing to take the time to tell (or write) a complete story when describing a critical incident.

Based on the experience of using this technique in this study the following observations and recommendations are made for its future use.

Observations and Recommendations

Observation 1

The use of critical incident technique is best optimised when an individual has recently experienced the events being researched. The longer the gap between the event and its recall it becomes more likely that key elements may not be fully remembered.

Recommendation 1

CIT should not be used for general data collection where other techniques such as semi-structured interviewing may be more appropriate.

Observation 2

Observation one influences this second observation as the identification of participants for interview is key to this technique being fully utilised. An individual who does not have a first hand knowledge of the phenomena under investigation (e.g. due to inexperience) will not make full use of the interviewer’s time. As such, to do this the research question needs to be fully scoped as well as the identification of interviewees who can contribute to providing valid data. To identify such individuals may entail a long lead in period before interviewing can take place.

Recommendation 2

The researcher must ask the question, “Is it essential to use individuals who have recent, first hand direct experience of the phenomena?”

○ If these types of individuals are needed the appropriate steps need to be in place to identify them.

○ If they are not needed the researcher should select another method.

Observation 3

The critical incident technique is a powerful tool that has the potential to elicit negative recall. This is more likely to be the case where events being recalled had a major impact on the individual, for example, witnessing a death. Such extreme events are likely to be more common in high hazard industries such as construction. This is potentially a health and safety danger to both the interviewer and the interviewee.

Recommendations 3

• As outlined in recommendation two.
• Procedures need to be in place at the onset to enable the interviewer to deal with this event should it occur.

• Counselling services may need to be available to the interviewer and the interviewee to deal better with the incident, if required.

• The HSE ethics committee should give approval before this technique is used.

Observation 4
Because of the open-endedness of the technique, long pauses are used to allow the interviewee to reflect before they respond. The interviewer must not make any attempt to intervene during these pauses and must be comfortable with them. As the responses made by the interviewee must be their own the interviewer must be sufficiently skilled not to attempt to lead, but at the same time keep the interview going to elicit appropriate responses from the interviewee.

Recommendation 4
Interviewers must be trained in basic interviewing technique and then trained specifically to facilitate a CIT interview. Interviewers should have a Psychology or other social sciences background.

Observation 5
As the interviewee may have limited experience of being interviewed and almost certainly have no experience of CIT interviewing they may also become uncomfortable when the interviewer is silent (encouraging gestures, e.g. smiles and nods can be used by the interviewer during silences).

Recommendation 5
Once an interviewee has been identified, ideally a pre-orientation visit should be made, about a week in advance to discuss how the technique will be used and establish expectations between the interviewer and the interviewee.

Observation 6
Interviewers should be sufficiently experienced to be able to identify emergent themes from an interview and follow them up accordingly

Recommendation 6
Only skilled interviewers should be used during the interaction.
**Observation 7**

In order that the interviewer can concentrate solely on facilitating the interview a good quality audio recorder should be used.

**Recommendation 7**

Identify and use good quality audio recorders.

**Observation 8**

An objective analysis is essential to extracting key critical incidents from the interviews. Hearsay and subjective interpretation must be eradicated from the analysis. The research question must be clear from the outset and remain unchanged through the research to prevent diluting objectively derived data.

**Recommendation 8**

The analytical technique used must be scientifically valid and supported by the literature. An expert versed in analytical techniques must do the analysis.

**Observation 9**

To validate critical incidents, subject matter experts (SMEs) should be used who are independent of the research team.

**Recommendation 9**

Subject matter experts should be identified prior to the start of the research and their role clearly defined. They must be trained so that they are able to achieve high levels of both inter and intra rater reliabilities (see footnotes 6 and 7).

**Observation 10**

Most interviews are done on a one-to-one basis as the more people that are present the more intimidating the situation may become for the interviewee, especially if they have limited experience of the interview situation. This may make them more reticent in formulating their responses. If a second person is needed for the interviews, their terms of reference need to be made clear to prevent them interrupting and asking unnecessary questions, which are unsuitable for CIT.

**Recommendation 10**

Any second party to the interview must be made familiar with the interview technique and given clear instructions as to when and how to intervene. The facilitator must retain complete control over the situation at all times.
**Observation 11**

For all research the interviewers should be and remain neutral to the outcomes of the research. The collection of objective data must remain paramount throughout the process.

**Recommendation 11**

Interviewers should be recruited who have no vested interest in the outcomes of the research. This should also be stipulated for those responsible for analysing the data.
8    OVERALL RECOMMENDATIONS

The following recommendations are meant to respond to issues that arose during the project and will be useful in moving any other research forward. They do not aim to highlight any particular situation, but should be viewed as an opportunity to improve the research process among organisations.

1) Critical incident technique is a valid tool for this work, as it can capture detailed information about incidents, and could be used in any further studies. However, it is essential that any interviewer who is involved in the process is aware of the nature of the technique and how to proceed.

2) Discussions should be held with ConstructionSkills, especially in respect of the Construction Plant Competence Scheme (CPCS) to gather data in respect of existing and new competencies that could be incorporated into any future studies.

3) There is a need to progress with this work in the construction industry to build on those competencies that the literature has shown is relevant, and that needs to be explored further. The competencies outlined from the present research, is one step in that direction.

4) Any future work needs to be clearly defined, especially in terms of the recruitment of the participants, such as determining if they have experienced an incident. Further, they must be comfortable to disclose information.

5) Boundaries about the research process need to be established from the outset. The HSL and the HSE need to firm up working relations with external partners so clear expectations and roles are put in place from the outset.

6) Due to the possibility that flashbacks may occur when the participants are recalling the incidents, it is essential that the appropriate ethical issues are addressed.
9.1 APPENDIX I: BRIEF TO MANAGERS

Construction Industry/HSL - Dumpers and Excavators

We are part of a research team looking at safety issues involved in working with plant machinery on building sites. The team includes people from the Health and Safety Laboratory (HSL), the Noordwijk Risk Initiative Foundation (NRI), the Construction Plant Competence Scheme (CPCS), and ConstructionSkills.

For the research we are visiting construction sites around the country, to find out what is useful for preventing accidents and what could be improved. As part of this work we want to talk to employees who use dumpers and excavators as part of their everyday work.

We will be asking employees to tell us about specific experiences of working on a building site, for this we are only interested in what happened, we will not ask employees to name names; either of individuals, or companies that they have worked for. Employees will be asked to talk about specific events that they have personally observed and which they think show particularly good or especially bad safety practice.

The researcher will ask for examples of an event that stood out to the employee, and may include events that had trivial consequences at the time, but which could have had serious consequences under different conditions.

We guarantee confidentiality throughout and the information that is given will not be passed on to anyone outside of the research team and the information will not be passed onto management, or external organizations.

The purpose of us talking to employees is that they are the experts. They are professional people who are doing the work. The information gathered in this type of study is difficult to get hold of in any other way than by asking people like your employees, the people actually working in the industry, as they are in the best position to say what happens day to day in their work. Our interest is in how the work was done and what can be done to help employees in their professional goal of working as safely as possible.

From the research we hope to establish a programme in order to make continuous improvements in the construction industry’s safety initiatives.

We would like to thank you in advance for your cooperation and help in allowing your employees to share very useful information, and to reinforce to you again that confidentiality will be maintained throughout the research and no information will be passed outside of the research team. As a participating employer you will be given the opportunity to comment on the final report before it is published.
9.2  APPENDIX II: THE INTERVIEW SCHEDULE

Introduction and Questions for Interviews

Construction Industry/HSL - Dumpers and Excavators

INTRODUCTION to Participants:

We are part of a research team looking at safety issues involved in working with Plant machinery on building sites. The team includes people from the Health and Safety Laboratory (HSL), the Noordwijk Risk Initiative Foundation (NRI) and the Construction Plant Competence Scheme (CPCS).

I am …

This is … from CPCS.

To find out what is useful for preventing accidents and what could be improved, we are visiting construction sites around the country. We are talking to people at different sites who are using dumpers and excavators as part of their everyday work. These are the experts we are looking for in this study. One of them is you.

We would like you to tell us about your specific experiences of working on a building site. We will not ask you to name names; either of individuals or companies you have worked for; we are only interested in what happened. We want to hear about specific events that you have personally observed; events which you think show particularly good or especially bad safety practice.

Each of your examples should be about an event that stood out for you. Please start with a positive example, and give a brief factual account of something:

1. that you personally observed and,
2. resulted in something that was particularly good (or not so good),
3. or avoided a potential problem (or could have caused an accident).

You may, if you like, choose events which had trivial consequences at the time, but which could have serious consequences under different conditions.

We will guarantee confidentiality. The information you give will not be passed on to anyone outside of the research team and you should not fear that this information will be passed on to management. So, please be open and specific.

We’ve tried to anticipate some of the questions you might have regarding this study:

Q. Why are you asking us?

A. The answer to that is very simple. You’re the experts. You’re professional people and you are doing the work. It’s been shown time and again that the people doing the job are the ones who know what’s going on.
The information gathered in this type of study is difficult to get hold of in any other way than by asking people like yourself, someone actually working in the industry, as you are in the best position to say what happens day to day in your work, what goes well and what can go wrong, or what went wrong.

Q. Does this have anything to do with checking up on individual people?

A. Absolutely not! You’ll note that we won’t ask you to give names in your examples. We’re interested only in how the work was done and what can be done to help you in your professional goal of working as safely as possible.

Q. What examples are you asking for?

A. We’re asking you for three or four events.

1. Most recent example of a job or operating situation using a _______ in which you felt that health and safety practice was particularly good.

2. Most recent example of a job or operating situation using a _______ in which you felt that health and safety practices could have been better.

3. Another example of a job or operating situation using a _______ in which you felt that health and safety practices could have been better.

4. Another example of a job or operating situation using a _______ in which you felt that health and safety practices were particularly good.

Before we start, may we ask you for permission to use a recording device. This allows us to concentrate on what you are telling us instead of writing notes. It also allows us to create an accurate write-up of our discussion; we’ll send you a copy.
**Question to START the interview:**

First example:

From your personal experience, think of the most recent situation in which you observed a job or situation in which it was easy to operate or maintain plant equipment (dumper / excavator) in an effective, reliable way. We would like to have you take the time to think over your examples.

...

In case the interviewee is asking more questions or for examples, the interviewer can use “Case A”.

We’d like to give you an example from a different industry that should make it easier for you on what we are looking for: (Note: the interviewer may play two roles here)

Case A (positive)

Q: When and where did this happen (approximate date and place)?
A: August 19. In the A-Building, in the process room.

Q: What equipment and/or what type of job was involved?
A: Module removal tool.

Q: Briefly describe the situation at the time (process or machine running, process or machine shut down, abnormal operating conditions, etc.).
A: The process was shut down for removal of modules.

Q: Exactly what occurred?
A: The tool functioned as designed and modules were removed from their positions with little or no delay and with no chance of dropping the pieces.

Q: Why do you classify this as being an especially easy operational or maintenance job?
A: Many of our tools are too heavy to use or ineffective for the job they are designed to do. This is not the case with this tool (2 different tools).

Q: What might have been expected from less effective plant design or procedure in this situation (e.g., more difficult to perform, more chance for error, or more chance of equipment damage)?
A: More time consumed during the operation with possible damage to the modules.

Only if interviewee stalls: the interviewers should go ahead with one of the following questions (see also prompt list):

1. When and where did this happen (approximate date and place)?
2. What equipment and/or what type of job was involved?
3. Briefly describe the situation at the time (process or machine running, process or machine shut down, abnormal operating conditions, etc.).

4. Exactly what occurred?

5. Why do you classify this as being an especially safe operational or maintenance job?

Interviewers should use the Prompt List to make sure all topics have been covered.

After finishing with this first memorable observation, ask for a

Second (negative) example:

From your personal experience, think of the most recent situation in which you observed a job or operating situation for which it was not easy to operate or maintain plant equipment (dumper / excavator) in an effective, safe way.

PROMPTS

1. When and where did this happen (approximate date and place)?

2. What equipment and/or what type of job was involved?

3. Briefly describe the situation at the time (machine running/shut-down, the job in-hand, unusual situation, etc.).

4. Exactly what occurred?

5. Why do you think this is an especially difficult operational or maintenance job?

In case the interviewee is asking more questions or for an example, the interviewer can use this “Case B”.

We’d like to give you again an example from a different industry that should make it easier for you on what we are looking for:

Case B (not so positive)

Q: When and where did this happen (approximate date and place)?

A: Last winter, in Building 207, Room C.

Q: What equipment and/or what type of job was involved?

A: Cooling tower pump house.

Q: Briefly describe the situation at the time (process or machine running, process or machine shut down, abnormal operating conditions, etc.).

A: It was really cold weather. There were two roof vents running, and the heaters were on.

Q: Exactly what occurred?

A: Two roof vents running cooled the room to a point where the piping froze-up.

Q: Why do you classify this as being an especially difficult operational or maintenance job?
A: There should be more variation in the flow of air out of the building. One vent on is often too much but yet some flow is needed.

Q: What might have been expected from more effective plant design or procedure in this situation (e.g., easier to perform, less chance of error, or less chance of equipment damage)?

A: At a set temperature one or both roof vents could shut down and at a set high temperature one or both could come on automatically. Or there could be switches to control a variable speed exhaust fan in roof vents.

Interviewers should again use the Prompt List to make sure all topics have been covered.

After finishing with this first memorable observation, interviewer should ask for a

Third example (a positive one again, see above first example)

If no known positive example, interviewer should ask for another negative example, see the second example above)

Again, interviewers should use Prompt List to make sure all topics have been covered.

And before explaining what now will happen, the interviewer should ask two final questions:

Is there anything that you think needs immediate attention or improvement?

Is there anything more you would like to add or make changes?

Thank you for your cooperation and help in sharing this very useful piece of information.

The interviewers should explain the next steps:

The recording will be written-up (the transcription). Confidentiality will be granted. There will be no names of persons or other confidential details in the written notes. Both interviewers will review the notes. The notes will then be sent to the interviewee.

When all interviews are finished (there will be about 20 interviews), there will an analysis, discussion of results by the research team and others from the construction industry. A final report will contain the results and a proposition on how to continue with this kind of interviews. We hope to establish a programme in order to make continuously improvements in the construction industry’s safety attempts.
**Prompt List**

For Interviewers only (do not give to interviewees)

Do NOT use this list as a questionnaire or script for the interview

How to use

At the END of each case described by the interviewee, make sure that all topics have been addressed satisfactorily.

Tick off the items that the interviewee has covered.

For items that have not been addressed, put the issue from the prompt list to the interviewee as an open question, e.g.

- Who was involved?
- When did it happen?
- Where did it occur?
- Why do you think this is important?
- How did it happen?

The interviewers should not guide the interviewee with leading questions or try to support theories.
### Overview of Incident

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A. Interviewee (GENERAL)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Current JOB of interviewee?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AGE of interviewee</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TRADE of interviewee</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>How LONG has interviewee worked in the construction industry?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>What BASIC TRAINING has interviewee received? Refresher?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Trained WHEN and by WHOM?</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>B. People (specific to incident being recalled)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>INSTRUCTIONS given before start of memorable occasion</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Interviewee EMPLOYED by the principle contractor</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Interviewee a SUBCONTRACTOR</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Interviewee EMPLOYED by a subcontractor</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>What CARD did the interviewee hold</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>OTHER PEOPLE involved?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Basic TRAINING of other persons involved, refreshers?</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>C. Process</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Process / situation – CLEAR and DETAILED?</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Was this process / situation a SPECIAL duty or NORMAL task?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>SITE LAYOUT?</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>EQUIPMENT e.g. serviced, familiar, new, type, condition, deficiencies, etc</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>How was the mechanical DESIGN of specific components?</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>How did people REACT to the EQUIPMENT, e.g. turned something wrong way, overshot, assembled wrong, misinterpreted instruments?</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>What written PROCEDURE was involved?</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Was there CONFUSION, RUSH or AMBIGUITY</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Was it a POSITIVE or NEGATIVE outcome?</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Why do YOU THINK of this as positive - negative?</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Why do you think this CAME OUT positive - negative</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Is this example COMMON? Everywhere or just some places? Why? Why not?</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Involvement of MAINTENANCE people?</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>D. Circumstances</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>DATE</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>TIME</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>VISIBILITY (Daylight/dusk/night/fog/…)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>WEATHER</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>SHIFT</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>OTHER equipment involved</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>E. Others</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Is there IMMEDIATE ACTION needed (on what)?</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Is there ANYTHING ELSE YOU WANT TO ADD?</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX III: AN ILLUSTRATED EXAMPLE OF A CRITICAL INCIDENT

<table>
<thead>
<tr>
<th>Critical incident number</th>
<th>No 1 (W1, I2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience (personal or other party)</td>
<td>Personal.</td>
</tr>
<tr>
<td>Characteristics of interviewee (e.g. age, gender, education, experience)</td>
<td>Male, Aged 43. Learned to drive and operate dumper on the job and has attended a health and safety course and induction on the current site.</td>
</tr>
<tr>
<td>Vehicle type (dumper or excavator)</td>
<td>A dumper.</td>
</tr>
<tr>
<td>Descriptive account of site operations where incident occurred (e.g. large scale house building, small scale demolition)</td>
<td>Very large groundworks site for a new housing development.</td>
</tr>
<tr>
<td>Outcome Positive (something that went well) or Negative (something that went wrong)</td>
<td>Negative.</td>
</tr>
<tr>
<td>Accident or Near miss</td>
<td>An accident.</td>
</tr>
<tr>
<td>Summary of incident</td>
<td>The interviewee was driving the dumper in reverse when he suddenly noticed an individual behind him. The interviewee braked, but the vehicle did not stop due to the muddy site conditions.</td>
</tr>
<tr>
<td>Critical environmental factors</td>
<td>Site conditions (mud).</td>
</tr>
<tr>
<td>Critical behaviours</td>
<td>Not seeing the other individual in sufficient time.</td>
</tr>
<tr>
<td>Critical behaviours of others</td>
<td>The injured person was not wearing a high visibility jacket and should not have been on this part of the site.</td>
</tr>
<tr>
<td>Any other indirect factors</td>
<td>None identified</td>
</tr>
</tbody>
</table>
### Table 9.4.1: Overview of Influencing Factors

<table>
<thead>
<tr>
<th>Influencing factor</th>
<th>Definition</th>
<th>Examples</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unsafe/poor driving</strong></td>
<td>The vehicle is driven in an unsafe way. This may be due to lack of situational awareness/concentration, complacency or inadequate training/experience. Organisational factors may also be included here, for example by directly or indirectly supporting poor driving behaviour.</td>
<td>Driving too close to the edge of a hole.</td>
<td>12</td>
</tr>
<tr>
<td><strong>Poor procedures/practices or procedures not followed</strong></td>
<td>Site operatives follow poor procedures or do not follow procedures, as they should have.</td>
<td>Dumper travelling up a very steep incline.</td>
<td>15</td>
</tr>
<tr>
<td><strong>Pressure to work unsafely</strong></td>
<td>Encouragement to get the task completed quickly, for example due to piecework or encouragement from other staff.</td>
<td>Work influenced by wanting to complete the job to ensure they get paid.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Condition of the vehicle or equipment that could have influenced the incident.</td>
<td>Quick-hitches wearing out quickly.</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 9.4.1 continues*
<table>
<thead>
<tr>
<th>Influencing factor</th>
<th>Definition</th>
<th>Examples</th>
<th>$N$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language barriers</strong></td>
<td>Communication failure due to site workers not understanding messages. Lack of understanding of English being a key factor.</td>
<td>Workers acknowledging that they have understood a message about safety when they did not.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Lack of awareness of other site workers (i.e. not including plant operators)</strong></td>
<td>Site workers working in an unsafe proximity to plant. Use of mobile phones also included as further distractions.</td>
<td>An engineer completing a notebook too close to plant.</td>
<td>8</td>
</tr>
<tr>
<td><strong>Poor health and safety knowledge or lack of application of safety knowledge (for example due to complacency)</strong></td>
<td>Operatives unaware that what they are doing is unsafe or simply working in an unsafe manner.</td>
<td>Stacking a load too high - limiting visibility.</td>
<td>6</td>
</tr>
<tr>
<td><strong>Training issues</strong></td>
<td>A factor may be in some way linked to the training provided to an operator.</td>
<td>The machine was different to the one the individual was trained to use.</td>
<td>1</td>
</tr>
<tr>
<td><strong>No banksman</strong></td>
<td>The lack of a banksman, which could have contributed to an incident.</td>
<td>No banksman to warn that another site worker was too close.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Weather conditions</strong></td>
<td>Weather, particularly wet weather leading to mud on site could have contributed to an incident.</td>
<td>Vehicle slid down a muddy bank.</td>
<td>4</td>
</tr>
</tbody>
</table>
9.5 APPENDIX V: THE MAIN ISSUES TO EMERGE

A thematic analysis was used to extract the main concerns from the data, and a total of sixteen themes emerged as outlined in Table 9.5.1. The themes are presented in the order in which they arose and any subsequent sub-themes to surface were allocated accordingly. The full set of themes and sub-themes is presented in Appendix VI.

<table>
<thead>
<tr>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communication</td>
</tr>
<tr>
<td>2. Application of Knowledge</td>
</tr>
<tr>
<td>3. Elements of Safety</td>
</tr>
<tr>
<td>4. Experience</td>
</tr>
<tr>
<td>5. Control</td>
</tr>
<tr>
<td>6. Attitude</td>
</tr>
<tr>
<td>7. Relationships</td>
</tr>
<tr>
<td>8. Training</td>
</tr>
<tr>
<td>9. Plant</td>
</tr>
<tr>
<td>10. Environment</td>
</tr>
<tr>
<td>11. Resources</td>
</tr>
<tr>
<td>12. Demands</td>
</tr>
<tr>
<td>13. Site</td>
</tr>
<tr>
<td>14. Well - Being</td>
</tr>
<tr>
<td>15. Cost</td>
</tr>
<tr>
<td>16. Ethics</td>
</tr>
</tbody>
</table>

The theme that participants highlighted the most times was *elements of safety*. This was followed by *training*, *experience*, and *control*. The predominance of these areas underline that the knowledge and its application and management is a primary concern for the participants and could be seen also as a concern for the workers in this industry. The participants emphasised the following themes to a lesser extent: *ethics*, *cost*, *well-being* and *demands*.

An overview of the themes will be presented below, according to the order in which they emerged from the data.

9.5.1 Communication

The majority of the participants raised issues in respect of the communications theme. Two sub-themes emerged from this theme: *good communication* and *bad communication*. Good communication consisted of elements such as *good feedback between drivers* and *good to listen to (learn from) someone else’s experience*. Quite a few participants felt that they were able to a greater extent to ensure safe practice when they were able to communicate and converse with other drivers. As one participant stated when commenting on the *good feedback between drivers*:

9 The text in italics, that are within paragraphs, are to emphasise the themes and sub-themes that emerged
“Hmm yeah I mean you’ve got a banksman standing watching him but really he should tell the banksman when he’s going to reverse. So the banksman changes his position from the front of the machine to the back of the machine. You know what I mean and goes….., come through or stop you know? Because I’m always edging, trying to get through with the forklift and they're always usually in the way.”

(P13)

“You know what I mean? So, I send my banksman to see his banksman to tell him to stop.”

(P13)

This participant felt that it was necessary to ensure that a driver working in his vicinity knew of his actions and by communicating through the banksman, he felt that he was able to achieve this and thereby avoid a near miss or an incident.

Quite a few of the participants noted that most of the foreign workers that they encountered were unable to communicate in English and they felt that this could increase their exposure to any potential dangers on site. As one participant noted:

“Well it’s trying to explain certain things that you are going to be doing and sometimes you can’t get that across and you know if you can’t get it across to them they’re not going to be able to get something across to you if it’s a dangerous situation, so you know. If they can’t speak English and understand so well how will they take in the information in the inductions that’s one of the problems I’ve seen over the years, especially on big sites where you’ve got fifty, sixty men sitting in an induction on a Monday, probably ten, twenty of them can’t you know. I was doing an induction on the A13 and one guy was copying everything on another guy’s sheet so they both had the same name and address and everything. You know, it’s not on really.”

(P11)

A couple of the participants felt that an adequate knowledge of English should be a requirement for working within the industry in order to ensure that they are able to perform adequately when on site, especially in terms of assessing dangerous situations.

10 “In British civil engineering, a banksman is the skilled trade which directs the operation of a crane from the point near where loads are attached and detached.” - http://en.wikipedia.org/wiki/Banksman (can also be called Banksperson or slinger signaller)

11 The text in italics that is enclosed within quotation marks relates to verbatim comments from the respective participants. P = Participant
“Before they get the training. If they’re going to bring Polish lads over here, some of them are really good, they go to night school and they really try. And anybody who tries, most places, everybody will help. You know what I mean, you try and...? But there is a few that don’t bother. They’re only interested in talking Polish to their friends, not bothering. All you get ‘me know understand’, [sic] and that makes life really hard out there in the workplace. So if you’re fetching them in and training them here, English should be part of the training. So they understand it.”

(P8)

“I got on with them lovely. I’ve got no problem with other people coming into this country to find work, no problem whatsoever. But I’m most definitely of the view that they ought to be able to speak a nominal amount of English. Because you can’t warn them and you can’t understand them trying to warn you. I’m sorry but I’m a great believer in that. They’re dangerous on site. Because you honestly cannot warn them, that if they haven’t got the vocabulary there to be able to warn them that this could be a problem that could be a problem, have you made them aware of the health and safety implications.”

(P16)

9.5.2 Application of Knowledge

The next theme to emerge focused on the application of knowledge. The sub-themes to arise from this theme included acknowledging that practice improves on the theoretical/practical parts of a course, that confidence improves with practice and also employers monitor employees with limited experience. Most of the participants commented on various aspects of this theme. For example, a few noted that individuals could play down complexities of heavy machinery (and this could involve an) element of risk. As one participant stated:

“It’s when you see how dangerous it is because people sometimes can ignore, oh it’s easy, it’s like that, it’s like that, but it’s not the same thing. Because it’s heavy machines and sometimes to stop the machines is not like a car, just brake or...”

(P1)

The sub-theme that generated the most comments from quite a few of the participants focused on the need to take account of different controls/movements of machines. According to one participant, this was especially necessary when operating different machines or not having been on a machine for some time:

“Under pressure, no time, they don’t give you time. Like you say, really if you haven’t been on a machine - in my eyes if you haven’t been on a machine set for a week, fortnight, three months, whatever, like I’ve been away for a week, I could have done with a 10 minute refresher before jumping back on a machine in my eyes, that’s better off all around in my eyes, for health and safety reasons, I’ve not been on it for a week, it’s not quite easy how to use a machine, you forget what button does what and what button does other because I probably gone [sic] on to another site and used another one which is different and harder to use but then coming back to another one, different buttons, blah, blah, blah, a
good 10 minutes, right, sit down, that does that, that does that, here’s your handbook, have a quick look through and away we go which I think should be on every site and should do it every time you want to use a machine if you’ve been away for longer than a week which I have. So it’s - what can I say? It’s all down to health and safety. You should have refresher courses every so often in any case in my eyes.”

(P5)

9.5.3 Elements of Safety

This theme generated the most comments from the participants and the primary sub-themes were, hazard, danger abounds in real life, risk, good safety practices, poor safety practices, accidents, supervision, and near miss. All of the participants provided comments on some aspect of this theme and this illustrates the importance of safety to them, especially within their working environment.

A few of the participants provided comments that suggested that they tried not to engage in dangerous actions. This included being aware of others to ensure that neither they nor their colleagues were in danger. As one participant noted:

“These lads put the levels on, I crop them off. Their life is in my hands really because they know you’re either good or you’re bad. I mean some lads they’re not bothered about people down trench, [sic] but these two they’re my mates, you know what I mean? So you’ve just got to be careful like that.”

(P4)

Most of the participants ensured that any machine they used was safe to drive, and this included noticing any irregularities in the ‘feel’ of the vehicle once they were in it as participant 5 did:

“Come on job Monday, yesterday, said right, we’re filling up a load of soil to put into the skip, can you get on dumper, move this particular - so the guy will load up, you’ll take it to the dumper, put it in the dumper so walked up, gets on the machine, on the dumper, ton and a half dumper, sat down, seatbelt on, started it up, moved back and the seat went. Stopped it, seatbelt off, got off. Looked at it, it’s not been repaired so I said right, left it where it were [sic] which was luckily at side of fence where it come round. Went down to (name of individual) we call him, LCD gaffer, said to him dumper seat not been repaired, has it been used? No, so he says whether it has or not I don’t know because I’ve not been here for a week, any chance of getting it repaired, did tell you before I went away because it wasn’t locking. He said yeah, said there was nowt [sic] wrong with it, I said hang on, sat on it, moves backwards and forwards, nowt [sic] wrong with it so I said can I have a mat again please, I want it repaired while I’m here, I’ll watch him do it. He said right, no problem, within half an hour they were here, stood and watched him repair it, one of the levers on the rail at bottom had bent and it weren’t [sic] catching on the teeth so it was going backwards and forwards. Took the lever off, put a new lever on, it works fine now, not a problem whatsoever.”

(P5)
While only a few participants highlighted that employers ensured that workers have the appropriate personal protective equipment (PPE), they felt that the PPE helped to make their jobs that much safer, and improved the conditions on a work site.

“I mean to be ... when I first started years ago I worked in steel works and we were contracted in there. It’s the same with plant and everything. There were no such thing as ear muffs and you do get partially deaf, because we used to have them concrete rakers, we put them hammers on machines, and you’re having them on all day and it does affect your hearing. But I mean now you’ve got all these ear protectors and everything which now anything what comes up I’m all for you know. Good thing. No he’s, as I say, he’s keen. Like this job we’re on down there at bottom, just starting up that and he’s been making them all wear gloves and, you know, which ... it’s all money at end of day isn’t it, somebody has got to provide them haven’t they? And your goggles and, not so much for me, but ear muffs in machine that lads round about, you know, they’ve got earmuffs on and everything. Aye, it makes life a bit easier when job [sic] is safe enough isn’t it? And the canteen is right enough, you’ve got a canteen and plenty of cabins for, you know, having a cup of tea and whatever. He’s all right. I’ve known a lot worse than him I’ll tell you.”

(P4)

However, one participant was concerned that if the PPE was not of the right quality the effects could be detrimental to the individuals wearing such equipment, if something adverse was to occur. Further, this individual felt that some equipment might not be appropriate under some conditions. For example, this person noted that wearing goggles when it is raining could affect visibility and thereby create a hazardous environment.

“They’re implementing the safety goggles which is another thing I think is a load of bloody rubbish because if they’re not high impact glasses and something does hit you, you’re going to end up with a load of plastic in your eye, and I think that’s a very, very bad idea. And I did say to them I’m not wearing them because if something hits me in the face I don’t want to be hospital [sic] with someone picking about eight pieces of sharp plastic out of me eyeball. You know what I’m saying if you’re wearing goggles on a dumper and it’s pi****g down with rain you’re driving up and down here, how are you going to see, you’ve got no wipers on the goggles have you? So you know, and they don’t stop them working in the rain here, they don’t say I’m going in out of it. We were sitting here last week and it was lashing all day and I was out, so that can be a safety factor as well like you know, especially with the dumpers going up and down.”

(P11)

Most of the participants stated that it was necessary to be aware of your surroundings (people, buildings, tanks) when operating large machines. They felt that this was essential to reduce the risk of any incidents or accidents occurring. One participant felt that it might be necessary to act on this awareness, even when it may gain the disapproval of the manager.

“I’m very observant. I’m actually two thirds, nearly three quarters of a way through a construction NEBOSH. So I’m very aware of the health and safety. I’m an extremely observant person. I tend to, even when I’m working, I look around me all the time to make sure there is nobody around you and to make
sure that nothing can happen and I automatically think through any scenario that could happen - like using a hammer, I’m actually on a 33 tonne JCB at the moment with a hammer on it. I’m very much aware of sharding from the concrete and that sort of thing at the moment. So when people are walking around I’ll stop. Alright I might get looked at by the manager but I’ll still stop.”

(P16)

The majority of participants were aware that they had to accept personal responsibility for safety, and this was especially important when they did not get the support from their managers.

“Don’t get me wrong, I mean I’ve done 16, 15, 16 years at (name of company) and I’ve worked on jobs within jobs like the Jubilee Line was such an expensive job but I’ve worked for civil engineering from a different section on a job for them. They worked really good, superb but they also said, it’s up to you (name) your safety begins with yourself. So if you see something don’t just walk past it and say well it ain’t [sic] my job. You just implement it. But there are other jobs where the foreman, not the top foreman like the senior general, or the general it’s the other foreman on the ground who say, oh just get on with it. When you point something out and they go, well it’s nothing of [sic] your business. And yet it is your business so that’s where I come into conflict with foremen before about it and on big jobs they’re not a problem. Well I don’t have a problem anyway, I don’t.”

(P2)

A few participants raised a poor safety practice that they felt could lead to an incident or accident if not addressed. They noted that individuals on site with private vehicles/engineers did not give way to heavy machinery, and that this was a practice that affected the safety of individuals when on site.

“What you do get on these sites though, is a lot of private people with their private cars. Or say (name of company)’s vans or some (name of company) vans maybe and they’re a bit trigger happy shall we say? It’s not, and you find that you’ll see a big dumper, Moxy coming down the hill and normally, the normal practice is to give way to that. No matter how wide it is give it way but they don’t, they just pull up and things like that. That’s the only thing I would say is wrong and too many people not having the flashing lights on their cars and things like that.”

(P2)

Another poor safety practice that was mentioned by the majority of participants was that some workers do not have an interest in safety awareness, ignore safety measures or engage in complacency. This they felt put those individuals at risk, especially considering the nature of the industry. As one participant stated:

“I’ve seen some ridiculous things when I’ve been on sites. Absolutely ridiculous. People walking behind the backs of machines, really oblivious to what could happen to them and things like that. But a lot of that is either complacency or
just they haven’t got a clue. They’ve come into the industry from other industries and really have no idea of how dangerous it can be.”

One poor safety practice brought up by quite a few of the participants was the poor or no maintenance of vehicles by some individuals or companies. This they felt was a practice that could have disastrous consequences as highlighted:

“The guy forgot to put the pin in, it slewed round, the bucket came off and killed the guy. You probably know about that. The wear on quick hitches is pretty severe if they’re not greased properly and they can, if you’re digging down deep and you get a lot of clay compacted in the mechanism it won’t work properly, even on the hydraulic ones. And I find that very dangerous which is the thing I...”

A couple of participants felt that it was not necessary at times to attend toolbox talks as they did not see them as valid or adding value. One participant stated:

“... I’m sort of 28 and I’ve been doing it a lot, a few years I drive a machine myself, and that’s the best way to do it, sort of talk about things first and they don’t want to go to these toolbox talks and SOSs and all that and half of it’s rubbish, it turns into a bit of paper that you get the same everyday and you don’t bother looking at it then, you just say well, ...”

However, the majority of participants thought that attending inductions/lectures/toolbox talks on site was good safety practice and one that should be advocated to all workers.

A few participants raised the issue of the necessity of a seatbelt when operating heavy machinery. While a few thought that it was a good safety practice, a few others thought that not wearing a seatbelt might reduce the risk of harm or injury, as illustrated in the text:

“We were on a job at Worth I think it were, [sic] guy in a dumper, very small-ish one, one ton dumper, drops into a bucket, tipped it over, no seatbelt on, nothing. Luckily, if he’d had his seatbelt on it might have made it worse, he jumped off it, that could have made it worse for himself because he could have gone under wheels, could have gone under bucket or ought [sic]. It were [sic] like a private - it weren’t [sic] a site where we had a health and safety book or whatever, it was just a guy that were building, well, someone building a set of houses asked us to go in and block pave part of the road, the guys gone up a mound, down a mound, as he’s gone down it’s gone over because one-ton dumpers are very fragile so as he’s gone down he’s just gone.”
One issue to come up under the sub-theme of accidents was the idea that rushing tasks can contribute to accidents. A few of the participants felt that although the foremen or managers might try to pressure them to complete tasks they needed to stay in control of the situation to reduce any negative impact might occur with trying to complete tasks quickly and thereby not safely.

“No, sometimes you get the rushes on don’t you, where they want something done quick, but me personally it doesn’t influence me and the machine, if it’s not going to be safe then it’s not going to be safe. As far as I’m concerned I won’t rush for anybody it will be done. There’s rushing and getting stuff done efficiently isn’t there, keeping at it if they want something done you know, without stopping, having a fag, that’s the way you sort of knuckle down and get something done, but there’s no point in me trying to make the machine go as fast as it will go like, because you’re just going to have an accident aren’t you.”

(P11)

The sub-theme of supervision generated comments from quite a few participants, especially as they acknowledged that good supervision helps to alleviate problems on site. And while fewer participants raised the issue of a lack of appropriate supervision, the ones that did noted that without a good supervisor, a quick reactive request has the potential to induce risks and thereby contribute to an incident.

“You know if you’ve got a good driver, if someone jumps on the machine, not very experienced in certain things and someone will call them over, oh do us a favour mate, that’s when all the problems seem to happen then, they shoot over, gives them, you know, a different line of work, I mean only for 2 minutes out of their own environment, and that’s when things are more likely to happen. If they had a decent supervisor, I’d say no mate, look he’s here.”

(P3)

9.5.4 Experience

The majority of participants spoke about the different aspects of experience in respect of operating the machines. It is a theme that shows the importance that participants place on having/not having experience. For example, the majority of them accepted that an experienced driver is less likely to create problems and understand what is needed, and that this can only be obtained with experience:

“Well like lifting. Being in a dangerous position, you’ve got to position your machine right you know? That, that’s part of the experience of being a digger operator, is setting yourself up properly, preparing it, if you’re digging a trench right? You don’t know what you’ve got behind you. It could be all up and down and that; you should always prepare the ground behind you because that’s where you’re headed. Level it out behind you, a lot of guys don’t and they’re all on a...”

(P7)
Additionally, the majority of them accepted also that having limited or no experience can contribute to mistakes or errors as the drivers do not understand exactly what is needed for a particular situation, as one newly qualified driver noted:

“I’d only just passed my ticket two weeks prior. The actual experienced tele-handler wasn’t on site, he was actually, we have radios for on site contact and I was summoned by a sub-contractor to go and do some lifting for him on a bridge, steel work cutting the roof construction away from it, things like that. There was an experienced crane supervisor experienced in signalling alongside and I was the actual tele-handler operator that day, that morning. And basically I was working under supervision of the banks when I received the signal. A load was put onto the force, which I couldn’t, it wasn’t very much weight whatsoever, not a lot of weight, but the problem was the extension of the forklift was fully bunged out and as low down as it would go, I couldn’t clear the bridge to ground level. So I got it back as near as I could, put my machine into reverse, only moved back two foot on uneven ground, I couldn’t use the stabilisers on the forklift because I was so near bank, it was soft uneven ground. And then a mixture of lack of experience, lack of forward planning, lifting situations, the wrong piece of equipment being used to lift the thing going up.”

(P10)

The above quote shows also the adverse effects of the element of low control within the industry that was raised by quite a few participants, in that reactive tasks can lead to errors/accidents.

9.5.5 Control

The fifth theme to emerge was control. This generated sub-themes of low control and high control. The following quotes illustrate if the driver perceives that his/her control is low and his/her authority is being surpassed or even threatened by the banksman, then this can lead to a poor attitude and also contribute to a poor relationship by not respecting the knowledge and abilities of others.

“I think it’s to be like their … because as a banksman you got a lot of authority and they think you’ve taken something from them, you know what I mean?”

(P1)

“You know, because he knows how to put a … he’s the driver, he knows how to drive and sometimes they say ‘you want to teach me to drive, just come’, ‘no I’ll not teach you drive’ [sic] but I’m responsible for the load to go from there, from the first day it’s my responsibility. If he falls you say ‘it’s alright’, but if he falls I’m going to get the blame.”

(P1)

12 Control involves how much say a person has in the way s/he does his/her work. - http://www.hse.gov.uk/pubns/indg406.pdf
Half of the drivers noted that they retained an element of high control, as they were able to plan to ensure that the job is done correctly. This they felt helped them in maintaining a safe working environment.

9.5.6 Attitude

Attitude was a theme that produced sub-themes of negative attitude, positive attitude, job satisfaction, trust and tolerance. While only a few participants highlighted this theme, it is a theme that reflects those issues that can assist in promoting a safer working environment.

A few participants noted that they enjoyed their jobs, and this shows a level of job satisfaction. Additionally, there seems to be a link between job satisfaction and trust, which is illustrated in the following quotes:

“I had it when it was brand spanking new here, so if (named individual) can trust me with something like that then I’d appreciate everybody that’s working around me can appreciate it. But then like I said I really enjoy my job...”

(P14)

“I love my job. They’re not going to push me out. Not for anything. I love what I do. And if I can make it safer in any way, which is why I started the NEBOSH, then I will. And I’d do anything in my power to help any of those blokes out there that I work with. Even if they might back stab and h**ch like a bunch of old women.”

(P16)

Further, trust was a concept that seemed to improve working relationships:

“So, my foreman he’s bang on it, he trusts me and he’s let me have my head.”

(P2)

The aspect of tolerance that emerged illustrated that the management dealt promptly with drivers if an incident or accident occurred. As one participant noted, two drivers who were playing ‘chicken’ on dumpers were asked to leave the site after they collided and caused an accident:

“They both got sent away quite quickly to put it politely.”

(P9)

9.5.7 Relationships

The theme of relationships was the seventh theme to emerge, with sub-themes of good relationships and poor relationships. Quite a few participants commented on this theme, especially with respect to not respecting knowledge and/or abilities of others. Some participants
felt that they constantly needed to justify their actions and this hindered the effectiveness of their job at times, as noted:

“You know but with lifting equipment you can't just lift things you know what I mean? Even when I do lift things they're still complaining. You know I've got to see where I'm going.”

(P13)

9.5.8 Training

Training was the eighth theme to emerge and generated several sub-themes. The sub-themes to emerge were very diverse and suggest that training is an issue that raises some concerns for the participants.

For example, one of the sub-themes focused on the assumptions about driving competency/driving ability that might then impact on learning ability. These are assumptions that some individuals may have that might not be conducive to effective learning as mentioned:

“Just hammer into individuals how dangerous these things can be, do you know what I mean. People treat them far less seriously than what they can potentially be do you know what I mean. They think a bloke what [sic] can drive a car, been driving a car 12 month, gets on a 10 ton dumper probably doesn’t realise the kind of thing that that would cause. I mean I’m used to them [sic] machines do you know what I mean. But if he runs into a private vehicle on the road or something like that, and the kind of damage, so a little bit more awareness that it is dangerous stuff to drive and it can cause a lot of serious…”

(P10)

“Yes it’s enough to clear it. Yeah it is. Obviously the ground getting wet makes it slippery, makes adverse conditions, where a lot of operators will get over confident and do ... well I’ve been doing this for three weeks, they might have been driving for three weeks, they go in on the first day of it being wet, try and do the same as they did and away you go, and when they slide they slide totally.”

(P16)
Some of the participants noted that these assumptions were prevalent among the younger generation, and could work against learning effective driving techniques.

“No we need the people in the industry, otherwise the industry is dying, it’s the same as you get all the youngsters who want to get on, yeah I want to jump on this, I want to jump on that, but they’re not willing to learn you know. They’re not starting at the bottom, they come in, they wave their ticket, I can drive this, I can drive that. No you’ve got a ticket to allow you to sit in the seat, it don’t [sic] you can drive it.”

(P17)

Another sub-theme focused on continuous learning when on site, specifically that refresher courses were needed to ensure that all staff on site were aware of safety issues. The participants who raised this sub-theme felt especially that the engineers on site were not fully aware of the dangers all around them when doing their job as illustrated:

“We’ve mentioned this loads of times to, you’ve got engineers and Land Rover and you’ve got engineers and you’ve got men on the ground. They should be made to sit in a dump truck and have somebody outside to say, ‘Can you see him?’ ‘No.’ Because you’ve got blind spots all round the machine.”

(P8)

“Make them more aware and less likely to get in the way of machines. Engineers, you know, you’ve seen them sitting down. They’re dozy. [sic] You know, squatting down writing in his notebook.”

(P8)

The sub-theme, that was cited the most times by the majority of the participants, was the fact that receiving training does not mean that a driver is able to drive efficiently and effectively. Most of the participants were of the opinion that the receipt of a ‘ticket’ was only the first step in becoming a good driver.

“Well they think they can drive the machine... driving a machine is different than putting them to work; you know you’ve got to put the machine to work. You’ve got to understand the work, not understand the machine.”

(P12)

The relevance of obtaining the required training was called into question by a couple of the participants who knew individuals who did not have qualifications (tickets), but were individuals who they considered to be good drivers.
“Really I don’t know, I don’t know how you train them up, I don’t, I don’t. They can go on these courses and have say 5 weeks, they’re a waste of time because they’re only digging in a pile of sand, and I say lads can go on these to get your tickets and everything and I don’t really agree with it, I don’t honestly because I know lads who’ve been at it, same as myself, all their life and for some reason and another they’ve been ill or whatever and they can’t afford to get their ticket and they’re brilliant drivers. And then you get another lad who’s come out of [sic] pit and whatever and he’s got a ticket and he’s got a bloody job and its…”

(P4)

“But it’s a funny thing you get these tickets and the ticket don’t mean a lot. You could have a ticket, you know what I mean? And you could be a ... it could say on ticket [sic] you’re a machine driver, but at end of day if you haven’t got a ticket ... I know lads who haven’t got tickets and they’re brilliant drivers. The ticket don’t [sic] mean a lot. I once went out to (name of company), the other side of Chesterfield on that open cast there and I got a similar machine to that and we were doing deep drainage with drag boxes and everything, and I saw this chap there with one of these boards, I thought he was from social, and I said, ‘Can I help you?’ He said ‘No, I’m just looking’, he said, ‘We have us [sic] own tickets’. He said, ‘We’re not bothered about these tickets what you’ve got.’ He said, ‘We have us [sic] own.’ He said, ‘And you’ve passed it, you can handle that machine, you’ll get your ticket for 12 months on (name of company)’s sites.’ He said, ‘That’s the best idea.’ Which it is. It is. I mean the thing is you can go on all these courses, whatever you want, you get a ticket it don’t mean a carrot. It don’t mean to say you’re a good driver or not.”

(P4)

The majority of the participants were of the opinion that learning continues after the official training courses end, and that the real learning only commences when operating the machines.

“Yeah. I mean it’s the same with the excavator training. You know yourself, I said to you the other day, that... even though I laughed and joked... I spent a lot of money and I did my ten days. The amount of training that was actually packed into that 10 days was nominal really considering how much I’ve learned since I’ve actually been out on site. There’s only so much they can prepare you for.”

(P16)

Just over half of the participants felt that the quality of training had declined or was too basic. They believed that the criteria for gaining the qualification should be more stringent. As one participant highlighted:

“Well more intense test, it should be, pass and fail should be more strict. Because even when I’ve seen guys doing dumper tests, I mean I remember, I think it was only last year some Eastern Europeans did a dumper test on site, the guy put the cones out for them, they had to reverse into the cones. One guy he missed every cone every time he done it, yet he did it again and he passed.
How the hell did he pass, he shouldn’t have passed, he should have been told no, you shouldn’t be driving a dumper you’re going to hurt someone but no, he passed. I have seen that a few times as well.”

(P11)

As most of the participants were querying the usefulness of the qualifications, this could perhaps account for over half of them suggesting that a probationary/supervisory period should be introduced for newly trained drivers (e.g. a learner ticket).

Some of the participants felt that they, or a competent employer, were able to assess the competency of a driver in a short time (e.g. within five minutes), and that this was one way to ensure that the driver was suited for the task.

“They haven’t got any. It’s... it’s same as owt [sic] else it’s experience what counts isn’t it. I mean I’ve worked for (name of company), I’ve worked for everybody digging at side of cables and everything and you can go work for (name of company) and within 5 minutes they’ll tell you whether you’re stopping or you’re going. They’ll say take your hook, they don’t mess about, Irish, and if they’re digging round cables they want somebody who’s experienced.”

(P4)

Some of the participants noted that induction/tool box talks were used as ‘retraining’ when incidents occur on site, and while a few of them did not think they were useful, a few others felt that it did reduce unsafe practices, as stated:

“So therefore if you are caught doing something, you are back in induction. It’s like a retraining almost and I think that more people are bothered about... not getting stuck back in induction than anything else. That seems to be working.”

(P3)

9.5.9 Plant

The issue of plant arose as a theme, with several sub-themes that mainly centred on the operation and manoeuvrability of the machines. For example, quite a few of the participants noted that the controls differ on machines, and as such it takes some time to adjust when using different machines. Similarly, a few participants stated that as more skill is required to drive bigger machines that drivers should ensure that they are comfortable with these sizes of machines before attempting to operate them.

“There’s a big difference between a 6 tonner and a 9 tonner. You would be surprised and they’ve done that and they come on a big site like this where you’ve got the big Moxys roaring past you and everything like that. And it can be as intimidating as hell, even I can feel intimidated when I’ve got a Moxy
sitting under my b***side or a big 9 tonner. And I just think that they’re put onto the big machines too quick, seriously too quick.”

(P2)

Due to the fact that some participants felt that machines were not maintained as regularly as they could have been, one participant did suggest that very large companies should have their own dedicated plant inspector on site.

“And I’ve experienced this first hand. Any large company with a lot of plant, say, I don’t know, 20, 30 items should have a guy there, an Inspector, a Plant Inspector. Regardless of where all the sites are, they could be all over the country like (name of company)’s or, I’m not sure about (name of company), I’ve never worked with them before but...”

(P7)

Another issue that arose was that the design of the vehicle could restrict compliance with health and safety procedures. One participant said that

“Yes, well one was involved with in myself, we had a dumper, I never drove that make of dumper before, and it was..., it was up here, it was s**t high..., sorry, it was really muddy, I got on the dumper and I was driving around, and my foot slipped between the pedal and the brake, accelerator and brake. My foot got stuck, and I struggled to get my foot out before there could be anything done, for like distances on the pedals apart from each other.”

(P9)

“Yeah, another thing I can’t stand in this day and age why we haven’t got covered in dumpers. Especially when it’s pis***g, hammering down with rain, yeah they don’t rain the guys off; well you never see guys get rained off now. They’ll be going round this site on dumpers, full slashed in the face with rain and there’s nothing more dangerous than, that’s a disaster waiting to happen for someone to run over someone with one of those dumpers.”

(P11)

It should be noted that the incidents with the machines seem to be linked with adverse weather conditions as well.

9.5.10 Environment

The theme of environment was the tenth to emerge from the data. Quite a few of the participants highlighted that adverse weather can contribute to accidents, but slightly fewer noted that the site shuts down when weather turns bad. Although this theme was not one of which the participants spoke of profusely, it seems to be one that they deal with when necessary.
9.5.11 Resources

The next theme to emerge from the data was that of resources. A few participants raised issues around this theme, and the sub-themes were lack of manpower, financial constraints, high turnover, support and workers.

Two of the issues raised by a few of the participants were the lack of manpower that exist in the industry at the present time, which has perhaps contributed to the need by some employers to retain their good workers, as is illustrated in the quote that follows:

“Because the industry is desperate for operators, they just seem to let anybody with half, half an idea loose with the ticket. And it happens, it’s regular here. It takes, you’ve either got it in you, a natural ability to operate a machine or you haven’t. And percentage wise I would say, we’ve got some fantastic operators that we hang onto for years and years and years. And they’re really good but it’s natural to them, you know? Some real good operators.”

(P7)

A few of the participants highlighted that within the industry at the present time there is a need to rely on hire drivers who are transient, do not have an affiliation to any one company and do not follow any particular health and safety code. Some of the participants felt that these temporary staff tended to engage in unsafe practices, as they were not aware of the capabilities of the machine, nor were they aware of their surroundings and environment. For example, as one participant stated below, while young employees would get a thrill out of standing the machine on end, this could lead to an incident.

“Sub contractors and things, you see them picking pipes up and things; it’s too much for the machine basically. I’ve seen machines stand on one end you know and they think that’s great. You know, some young lad, ‘Oh look at this I can get it up on its front end’, and it’s obviously [sic], that he’s picking up more than the machine is designed to pick up isn’t it? Going on ground it shouldn’t be on, these machines can do a certain job and some can’t like you know? I mean you want on a, on a batter, on a steep angle you want a long carriage machine for stability; some machines have got a short carriage for trenching and what have you. We use; we generally use LCs on slopes and things. For stability. I’ve seen machines sliding down and I’ve actually seen one over on its side.”

(P7)

The issue of a competent workforce was of concern for a few of the participants. They noted that there was a lack of young workers who wished to work in the industry, and wondered about the position of labour within the short and long term.

“You can tell after 5 minutes of watching someone how they do bits and pieces, yes, just a dumper, I think your full tip and dumpers are sort of the biggest hazard you’ve got, you’ve got the drivers on them, and the 360s and 180s round here, and they’ve got 2 JCBs of their own, the self drive fellas, they’re both brilliant drivers, experienced as well on the ground. They’re not young. That’s what’s happening now, there’s no young people coming through. We’re looking
at our drivers at the moment, 55, 60, 65 and we’ve actually got one now who was 70 last week. We just can’t get him to go away, now, he’s the best driver we’ve got, he’s brilliant, he really is good.

(P3)

“No, we’re looking at our young fellas coming, we’re thinking who is going to drive these machines in 5 years when they retire, they haven’t got a clue, because you get all these young ones come out, cool, we want to drive a digger, want to drive a digger and they seem to do 2 and 3 day weeks, they don’t come back. No one is interested in this industry any more it seems apart from, well the Polish are. As I said, we’ve got some at the moment and some of them are quite good. All they want to do is drive the diggers, they can sit there in the warm, especially this time of year, they want to drive the digger.”

(P3)

“Going back to where I started, the hours are ridiculous, nobody wants to work a twelve hour shift, I don’t any more, I’m 53, I’ve done it all my life but you know, nobody works all them hours now man. The young lads especially, I mean I wouldn’t mind doing it, if I’ve got to do it I’ll do it but the young lads these days. Huh, I’ve had them come on and walk, walk away. You start at seven finish at seven. ‘What?’ And they just walk away.”

(P7)

One issue that seems to impact on how safety conscious an individual could be was their financial status. A few of the participants noted that due to the nature of the work some drivers might be unemployed for a considerable amount of time and would then need to decide if to challenge an employer on unsafe machinery/actions or ignore them in order to work and thereby gain an income.

“It’s a dog with no teeth. I go on a job, there’s a dumper there, now say I’m a married man, a young bloke with four or five kids. I’ve been out of work four months which is regular in this game. I go and get this job, you get on it, the brakes are iffy [sic]. Not really bad but you know there’s something wrong with them. You go to this guy, not big companies but smaller companies, ‘brakes aren’t very good.’ ‘There’s no lock on the gate kid.’ So I’ve got four or five kids at home, do I say, get off and say stuff your job? I’m on my now, haven’t got a problem, I can walk. But a guy with three or four kids, he’s got to weigh up, can he afford to say stick that job or does he risk driving that machine. He’s got no teeth to back him up. That’s what they keep saying, you shouldn’t do it but if you’ve got four or five kids at home and want feeding.”

(P8)

As illustrated above it may be difficult for some individuals to challenge an employer on unsafe work practices, and this difficulty is increased if they do not have the required support in place. A few of the participants commented on the lack of support within the industry, which made it difficult at times to engage in the right type of behaviour, or perform better on the job.
“Nowhere to report it. Yeah, you’ve got nobody to report it to. You’ve been trained so you’re taking the responsibility by driving that machine. But there’s other things [sic] involved when it comes to married men and kids. It’s not critical, them brakes but you know there’s something wrong with them and it could become a critical thing. I’ve said this since day one; you’ve got no back-up. We, all the onus is put on us, safety wise but we can’t.”

(P8)

“People like myself really. I think there is a bit of..., I don’t know if you’d call it racialism, [sic] there’s some areas on it, but I think if they’re accepted by somebody, they sort of..., they are sort of..., I’ve seen a Polish guy here as well, he’s gone now, but I think he didn’t get the same amount, somebody helping him along, I think they just need a slight bit of help in some places. And if somebody’s able to do that, it does help out a lot.”

(P9)

A small number of participants were of the opinion that some drivers have low literacy and/or learning difficulties exist within the industry. However, they did state that this was not necessarily a disadvantage to this particular type of work.

“A lot of factory industries and that sort of ... unfortunately plant operators tend to be in the lower bracket where it comes to IQ. Let’s put it that way. A lot of them can’t even read and write, to be honest. In saying that, a lot of them excel in this industry because of that, where people tend to be missing in one area they more than over-compensate in another area.”

(P16)

9.5.12 Demands

The twelfth theme to emerge was the demands of the job. From this theme, sub-themes of high demands, reactive demands and pressure to get the job done correctly arose. While this theme was not mentioned by very many of the participants, it was a theme that directly impacted on other themes such as elements of safety and resources. For example, a reactive demand usually arose when the required number of staff was not available and the pressure to get the job done correctly could lead to mistakes or errors and thereby contribute to an accident.

9.5.13 Site

The thirteenth theme addresses those issues surrounding the site. This theme consisted of six sub-themes and focused on size, logistics and facilities. Quite a few of the participants noted that safety issues are managed better on large sites, mainly because they have more money to invest in the site. Conversely, a few did state that safety is less rigorous on small sites as they have less money to invest. As one participant outlined:
“They cut corners don’t they? I mean if they couldn’t find a set of chains, they’d expect you to lift it with a strap, maybe not a shackle and not put it on your teeth or in your bucket, silly things like that which can cause a major accident, or a strap that’s got a bit of a nick in it and if you say no, I’m not going to use it they’ll make it hard for you on a smaller site and threaten to fire you, but you have to stand your ground like, you know, because it’s going to come down on you isn’t it if something happens?”

(P11)

Some of the participants thought that some of the sites should have a better planning of the logistics, as some of the equipment could inadvertently cause a hazard as outlined:

“Well take this site. I haven’t mentioned it to the Safety Officer yet, planning when they’re laying them in, a bit more of it. They put the tap right outside the toilets in the canteen; they have the jet wash there. We don’t get a lot of frost down here but if we do get frost slips and falls are the biggest injuries.”

(P8)

9.5.14 Well-Being

Well-being arose as the fourteenth theme, and facilitated sub-themes of fatigue, concentration/forgetfulness, the monotony of the job and rest periods.

For a few of the participants, fatigue was an issue within the industry. They noted that the job entailed long work days and is made more tiring as most of the workers live away from home and tend to drive to their homes on the weekend to be with their families. The additional task of driving home on a weekend adds to the fatigue levels among workers.

“And guys are travelling home at the weekends; personally I find it a real grueller [sic] now as I’m getting older but there you go. Fatigue amongst men honestly is a major factor of accidents as far as I’m concerned. You might be fresh enough on a Monday and Tuesday but as the week goes on.”

(P7)

Quite a few of the participants commented on the long workdays that are common within the industry and in particular on the (short) work breaks. They stated that more frequent or longer work breaks are needed over the course of their working day as expressed by one of those commenting:

“I actually rang the HSE one day, watching some of the people that I worked with, and on some contracts you work seven days a week and you’ll do a 12 maybe 14 hour shift for seven days and that’s continuous over a month and then maybe you’ll have a long weekend at the end of the month. Now I know this still happens, I know it does. And come the end of it you get tired, everybody does, it wears you down after a while. And I rang the HSE and actually asked, I’m a machine driver, I work in this environment, what is the legal minimum that we have to have for breaks? And I was told that we came under the Working Time
Directive the same as everybody else does, so therefore it’s 20 minutes every six hours. I was quite shocked at that actually.”

(P16)

Some of the participants felt that the job could be monotonous at times, especially when operating the dump trucks and as a result they would switch off from the task, as described by a couple of them:

“Especially on the machines, it’s monotonous. If you’re loading dump trucks for twelve hours a day it’s just...”

(P7)

“It happens a lot with dumper drivers actually. Dumper drivers go into what we call the zone, where you get into that machine; you switch off, because it is such a mundane and boring job. You switch off.”

(P16)

In addition, some of the participants highlighted that the monotony of the tasks could cause a lapse in concentration, which could then lead to negative consequences as detailed below:

“Yeah. But you think you might do some jobs ... we’ve been on some jobs where we’ve done 100/110 loads a day, back and forth, back and forth, back and forth, doing the same thing. And you could swear blind that ... I had an argument in a quarry when a chap tipped over a dumper right beside me. He swears blind he looks in his mirrors to check his skip before he tipped.”

(P16)

9.5.15 Cost

While one participant stated that employers address issues only when high costs are involved, quite a few participants were of the opinion that the cost involved in implementing safe practices dictated how much health and safety is observed. The overall perception of this theme is outlined in the following quotes:

“Well not really I wouldn’t have thought, I mean the only time you think they don’t show up is if they do damage. The only time you ever see it upsetting a firm is if it costs them money. If it don’t cost them money then at the end of the day they're not doing it for the love of job are they, whatever they tell you, it's all profit orientated.”

(P6)

“It’s all down to expense isn’t it? And don’t forget, these machines now, if we’re doing pins and bushes you’re talking major expense and they just won’t spend the money, there’s not the money there to do it any more.”

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Yeah. But you go to the fitters and you know damn well the fitters are under pressure from the bosses and the bosses are under pressure from the client, and there’s that never ending circle, it’s just money at the end of the day. But you can’t put a price on somebody’s life. You really can’t. I’d rather lose my job than do that.”

9.5.16 Ethics

One participant raised issues that lead to the last theme of ethics. This individual observed that there is more accountability in the industry at the present time, especially as very senior management can be liable for unsafe practices. This person felt that this was a positive occurrence in health and safety.

“Top people now can be up for murder.”

“And I think they have got to sort themselves out you know, ‘cos if anything comes back on them, they’re in big trouble.”
## APPENDIX VI: OVERVIEW OF THE THEMES

### Table 9.6.1: Overview of the Main Themes

<table>
<thead>
<tr>
<th>Themes</th>
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<tbody>
<tr>
<td><strong>Communication</strong></td>
<td></td>
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<tr>
<td>1.1 Good communication</td>
<td></td>
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<tr>
<td>1.1.1 Good feedback between drivers</td>
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<tr>
<td>1.1.2 Good to listen to (learn from) someone else's experience</td>
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<tr>
<td>1.1.3 Providing induction/lectures/toolbox talks on site</td>
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<td>1.2 Bad communication</td>
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<tr>
<td>1.2.1 Not listening to/communicating with banksman</td>
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<tr>
<td>1.2.2 Not listening to foremen/other workers</td>
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<tr>
<td>1.2.3 Most foreign workers cannot communicate in English</td>
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<tr>
<td>1.2.3.1 Not enough interpreters on site</td>
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<tr>
<td>1.2.3.2 Speaking English should be a requirement for working in the industry</td>
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<td>1.2.4 Not being informed of problems with machines</td>
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<tr>
<td><strong>Application of Knowledge</strong></td>
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<tr>
<td>2.1 Practice improves on the theoretical/practical parts of a course</td>
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<tr>
<td>2.2 Individuals can play down complexities of heavy machinery - element of risk</td>
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<tr>
<td>2.3 Confidence improves with practice</td>
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<tr>
<td>2.4 Up to individuals to follow rules/policies/procedures</td>
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<td>2.5 Experience is gained/improves with practice</td>
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<td>2.6 Employers monitor employees with limited experience</td>
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<tr>
<td>2.7 Need to take account of different controls/movements of machines</td>
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<td>2.8 Can learn from experienced drivers</td>
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<td><strong>Elements of Safety</strong></td>
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<td>3.1 Hazard</td>
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<td>3.1.1 Working in a confined area/space</td>
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<td>3.2 Danger abounds in real life</td>
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<td>3.2.1 Engaging in dangerous actions</td>
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<td>3.2.2 Driver error</td>
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<td>3.3 Risk</td>
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<td>3.3.1 Unintentionally exposing oneself to risk</td>
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<td>3.3.2 Working alone increases risk</td>
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<td>3.3.3 Working with quick hitches is dangerous</td>
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<td>3.4 Good safety practices</td>
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<tr>
<td>3.4.1 Not engaging in unsafe actions</td>
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<tr>
<td>3.4.2 Attending inductions/lectures/toolbox talks on site</td>
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<tr>
<td>3.4.3 Ensure vehicle is safe to drive</td>
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<tr>
<td>3.4.4 Vehicles are maintained</td>
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<tr>
<td>3.4.4.1 Driver ensures vehicle is maintained</td>
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</tbody>
</table>
Table 9.6.1: Overview of the Main Themes, cont.

| 3.4.5 | Do pre-start checks on vehicle                  |
| 3.4.6 | Ensuring workers have appropriate PPE          |
| 3.4.7 | Awareness of surroundings (people, buildings, tanks) when operating large machines |
| 3.4.8 | Employers monitor employees with limited experience |
| 3.4.9 | Ensuring appropriate signs/protective barriers/procedures are in place |
| 3.4.10| Management complies with/ensures staff comply with safety practices |
| 3.4.11| A banksman is made available                  |
| 3.4.12| Accept personal responsibility for safety      |
| 3.4.13| Awareness of terrain (e.g. unstable ground)    |
| 3.4.14| Wearing a seat belt                           |
| 3.4.15| Ensure drivers have relevant qualifications (tickets) |
| 3.4.16| Use operator's handbook/manual every time you go on machine |
| 3.4.17| Implement drug/breath testing on site         |
| 3.5   | Poor safety practices                         |
| 3.5.1 | Putting workers at risk (of harm)             |
| 3.5.1.1| Not as safety conscious                      |
| 3.5.2 | Individuals on site with private vehicles/engineers not giving way to heavy machinery |
| 3.5.3 | Not having appropriate safety signs/barriers in place/procedures (e.g. flashing lights on vehicle) |
| 3.5.4 | No interest in safety awareness/ignore safety measures/complacency |
| 3.5.5 | A banksman is not made available             |
| 3.5.6 | Poor/no maintenance of vehicles              |
| 3.5.7 | Lack of awareness of surroundings (e.g. people, vehicles) |
| 3.5.8 | Not attending toolbox talks - not seen as valid/valuable |
| 3.5.9 | Not wearing a seat belt                       |
| 3.5.10| No pre-start checks done on vehicles          |
| 3.5.11| Drivers employed without relevant qualifications (tickets) |
| 3.6   | Accidents                                    |
| 3.6.1 | Accidents occur more on smaller sites than on larger ones |
| 3.6.2 | Accidents occur more in confined spaces/areas/sites |
| 3.6.3 | Rushing tasks can contribute to accidents     |
| 3.6.4 | Lack of supervision can contribute to accidents |
| 3.6.5 | Continuously moving drivers between different machines can contribute to accidents |
| 3.6.6 | Fatigue can contribute to accidents           |
| 3.6.7 | Using old plant can contribute to accidents   |
| 3.6.8 | Cause of accident determined after it occurs  |
| 3.6.9 | Safest place on site is inside the cab of a machine |
| 3.7   | Supervision                                  |
| 3.7.1 | Poor Supervision                             |
| 3.7.1.1| Lack of appropriate supervision              |
| 3.7.2 | Good Supervision                             |
| 3.7.2.1| Good supervision alleviates problems          |
| 3.8   | Near miss                                    |
| 3.8.1 | Near miss report is not efficient as does not collect appropriate data/is not acted upon |
| 3.8.2 | No near misses observed but management wants near misses reported |

*table 9.6.1 continues*
Table 9.6.1: Overview of the Main Themes, cont.

3.8.3 Near miss is not reported
3.8.4 Near miss reported and acted upon

4 Experience
4.1 Negative aspects of experience
   4.1.1 Not listening to banksman/workers due to level of experience
   4.1.2 Some experience does not guarantee able to drive adequately
   4.2 Positive aspects of experience
   4.2.1 Employers monitor employees with limited experience
   4.2.2 Experienced driver less likely to create problems/understand what is needed
   4.2.3 Experienced foremen promote good practice
   4.3 Quality of Experience
   4.3.1 ‘All round’ experience not a valid statement - must have more experience on one machine
   4.3.2 Focus on mastering one or two things then the rest will follow
   4.3.3 Experience on one machine assists when learning to drive a different machine
   4.4 Limited/no experience
   4.4.1 Limited/no experience can contribute to mistakes/errors - not understanding exactly what is needed
   4.4.2 Newly qualified drivers asked to drive big machines too quickly
   4.4.3 Young drivers without experience are not hired

5 Control
5.1 Low control
   5.1.1 Work with different drivers/banksmen constantly
   5.1.2 Need to work to specific timescales
   5.1.3 Work with equipment given - may not be suitable for task/job
   5.1.4 Not organised
   5.1.5 Reactive tasks can lead to errors/accidents
   5.2 High control
   5.2.1 Able to make changes
   5.2.2 Able to plan to ensure job is done correctly
   5.2.3 Working with same colleagues (driver/banksman) constantly
   5.2.4 Can request and obtain necessary tools for the job

6 Attitude
6.1 Negative attitude
   6.1.1 Not respecting knowledge/abilities of others
   6.1.1.1 Not respecting knowledge/abilities of women
   6.2 Positive attitude
   6.2.1 Job satisfaction
   6.2.2 Employer trusts employees
6.3 Tolerance
6.3.1 Low tolerance of unsafe practices - drivers dismissed

7 Relationships
7.1 Good relationships
7.1.1 Individuals easy to work with
7.1.2 Can raise safety issues and they are addressed
7.2 Poor relationships
7.2.1 Not respecting knowledge/abilities of others
   Some foremen can be problematic (e.g. new on site, when changed) - try to force
7.2.2 Unsafe practices
7.2.3 Cannot raise safety issues/if raised not addressed

8 Training
8.1 Train under difficult/simulated site conditions
8.2 Learn with small machines
8.3 Assumptions about driving competency/driving ability - impacts on learning ability
8.4 Individuals drive machines for which they are not trained
8.5 Training is thorough
8.5.1 Need refresher courses/ensure all staff on site aware of safety issues
8.6 Receiving training does not mean able to drive efficiently and effectively
8.6.1 Probationary/supervisory period should be introduced for newly trained drivers
   (learner ticket)
8.6.2 Some individuals without qualifications (tickets) are good drivers
8.6.3 Companies have independent assessment for drivers
8.6.4 Need apprenticeships within industry
8.6.5 Banksmen should be trained more
8.7 Learning continues after official training courses end
8.8 Quality of training has declined/too basic
8.9 Training should be done on large machines
8.10 Able to assess competency of driver in a short time (e.g. within five minutes)
8.11 Induction/tool box talks used as 'retraining' when incidents occur on site
8.12 More training/qualifications does not mean an increase in remuneration
8.13 Log book system not an efficient way to assess learning

9 Plant
9.1 Automatic machines are easier to control
9.2 Controls differ on machines - takes some time to adjust
9.3 Bigger machines are less comfortable
9.4 More skill required to drive bigger machines
9.5 Easy to operate equipment in open area
9.6 A full dumper has restrictive movements
Table 9.6.1: Overview of the Main Themes, cont.

9.7 Should not continuously move drivers between different machines
9.8 Small machines are fragile - need to be careful when driving
9.9 Large machines are more stable - do not turn over as easily
9.10 Dump trucks are dangerous
9.11 Plant should be inspected regularly/have Plant Inspector on site
9.11.1 Hired plant not maintained as should be/used for longer than necessary
9.12 Design of vehicle restricts compliance with health and safety procedures

10 Environment
10.1 Adverse weather can contribute to accidents
10.1.1 Site shuts down when weather turns bad
10.2 Care needs to be taken when going up inclines

11 Resources
11.1 Lack of manpower
11.1.1 Need to rely on hire drivers - transient/no affiliation to company/own health and safety code
11.1.2 Lack of young workers who wish to work in industry
11.2 Financial constraints
11.2.1 Need to pay more for a ‘good’ driver
11.2.2 Finances dictate level of safety consciousness
11.2.3 Employ ‘cheaper’ workers
11.3 High turnover
11.4 Support
11.4.1 Good support
11.4.1.1 Teamwork
11.4.2 Low/no support
11.5 Workers
11.5.1 Good workers are retained
11.5.2 If no interest in profession then will never make a good driver
11.5.3 Some drivers have low literacy/learning difficulties exist
11.5.4 Some drivers willing to learn

12 Demands
12.1 High demands
12.1.1 High workload
12.2 Reactive demands
12.3 Pressure to get job done correctly

Table 9.6.1 continues
### 13 Site
13.1 Safety issues are managed better on large sites - more money to invest  
13.2 Safety is less rigorous on small sites - less money to invest  
13.3 HSE inspectors should monitor very small sites more as not as health and safety aware  
13.4 Better planning of logistics  
13.5 No facilities on site - shows a lack of welfare of workers  
13.6 Facilities on site - shows interest in the welfare of workers

### 14 Well – Being
14.1 Fatigue  
14.1.1 Long work days  
14.1.1.1 Working long hours more common with contractors  
14.1.2 Minimum work breaks  
14.1.2.1 More (longer) breaks needed during the day  
14.2 Lapse in concentration/forgetfulness  
14.3 Monotony of job  
14.4 Drivers should get out of cab during breaks - need to rest away from plant and walk around

### 15 Cost
15.1 Employers address issues only when high costs involved  
15.2 Cost dictates how much health and safety is observed

### 16 Ethics
16.1 Accountability  
16.1.1 Senior management are accountable for their actions/for safety of employees
10 REFERENCES


*References used in the literature review*


The usefulness of Critical Incident Technique (CIT) in eliciting plant competencies

A Pilot Study

The Health and Safety Laboratory (HSL) conducted the research on which the present report is based for the Health and Safety Executive (HSE). The research was contracted to examine the relationship between competencies and the reasons for accidents and incidents involving construction plant operators. The present research is the Pilot Phase of the project and is meant to establish the efficacy of a critical incident technique method.

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