EXPLORING FACTORS AFFECTING UNSAFE BEHAVIOURS IN CONSTRUCTION

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Why do workers take a chance and work from height without any safety protection? Is it because of their age, inexperience or lack of training? Is it to do with their risk perception or desire for risk taking and thrill seeking? Is it bad management style, poor safety culture or a substandard design? Does this happen everywhere around the globe or is it just one particular culture? To help us understand why there are different behavioural responses to hazards (e.g. working at height) in construction, we must first understand the factors that have affected that individual's decision-making. This paper presents early investigations taking place on a £1.6B project in the UK involving construction workers from many different backgrounds and nationalities. Through a process of literature exploration, a safety climate survey and focus group discussions, factors have been identified and explored to consider how they impact behaviours. The results suggest that time pressure, training, experience, risk perception, safety culture, culture and management are the factors most likely to be influencing behavioural responses of individuals. Time pressure is perhaps the most important factor as it was often regarded as having the greatest influence by the focus group. Survey results revealed 31% of 475 participants thought that alcohol and drugs were 'always' a factor in accidents, and hence this factor has somewhat surprisingly been identified as having a fairly significant influence. These factors will be further explored in future work using an ethnographic approach, which will yield significant insight from fine-grained, observational analysis on the project.

Keywords: behavioural safety, human response, time pressure.

INTRODUCTION

Over the last two to three decades, an increase in research and awareness in safety has reduced fatalities by over half (HSE, 2012). However, 22% of UK employee (employed and self-employed) fatalities and 10% of reported major injuries are in the construction industry despite only accounting for 5% of British employment (HSE, 2012). During this period, construction safety has reduced fatalities mainly through focusing on improving the 'hard' issues such as managerial systems, policies and better safety technology e.g. nets, MEWPs, harnesses. However, in recent times many organisations have realised that their accident rates have 'levelled off'. This has ignited a search for improvements in other areas to reduce accident numbers; and has led to the research into behavioural safety issues of the workforce.

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The £1.6B project is not only significant in size, but also multi-national in composition; the project team involving eleven major organisations from five different countries, the contractor Joint Venture alone comprising four separate nationalities, and a workforce of over 22 nationalities. This project has therefore provided the opportunity for a PhD study to investigate behavioural safety issues on a significant infrastructure project, and how these may be influenced by the many national cultures and backgrounds involved.

This paper presents the initial findings from the study, in the form of an exploration of the factors influencing behavioural safety issues, evaluated through a workforce-wide survey and further supported by a focus group discussion. Considerations of national culture influence will form the next stage in the project and are consequently not presented here.

IDENTIFYING BEHAVIOURAL SAFETY FACTORS

Within previous health and safety research, various factors have been identified as potentially contributing to behavioural safety issues. These are summarised below:

Alcohol and Drugs

Using the validated AUDIT test, a study (Biggs & Williamson, 2012) of nearly 500 construction workers in Australia deemed 286 (58%) were above the cut off score (8) for hazardous alcoholic consumption. Though it is not clear how great an affect hazardous drinking out of work hours will have on safety during construction, it would be naïve to think that none of the workers would be impaired. This problem is unlikely to be just isolated to Australia, especially when the global drinking habits are considered: vast areas of Europe, including the UK, consume more pure alcohol than Australia (World Drug Report, 2012). Regarding other drug use, 292 (59%) had used cannabis at some point during their life, with 16% admitting to using it within the last 12 months. 196 (40%) had used ecstasy or meth/amphetamine type substances (ATS) during their life, with 162 (32%) having used it within the last year. Comparing that with the whole of Australia: 10.3% admitted to taking cannabis within the last year, 3% ecstasy and 2.1% ATS (World Drug Report, 2012). Drug takers of such highs, are generally high risk takers that live for the "buzz" (sensation seeking). They are aware of the risks (e.g. heart attacks, addiction etc.) but the "buzz" feeling still outweighs this consequential thinking. Therefore, one would suspect that employees with such a buzz or high thrill personality trait would be more willing to chase adrenaline-rushes through risk-taking on site.

Experience and Training

These two factors could be strongly linked. Experienced and skilled construction workers are reported to being less prone to hazards than inexperienced workers (Laukkanen, 1999), while human experiences influence safe or unsafe actions on-site and involvement in safety management systems (Fang et al., 2004). There is evidence which suggests that more than half of all accidents on site occur within the victim's first week (Stokdyk, 1994). This indicates that training and in particular site specific inductions are perhaps important safety initiatives.

Management

The management have the opportunity to control risk and employ behavioural-based management systems. Such techniques are very important considering that 80 to 90% of accidents are triggered by unsafe employee behaviour (Lingard & Rowlinson,

2005) and that, in one study, risk management was a factor in 84% of accidents (Haslam et al., 2005). Unsafe behaviours are in the individual's control and also within the scope of supervisors and management to control effectively (Lingard & Rowlinson, 2005). Evidence implies that behavioural-based safety management systems are very effective in improving performance (Lingard & Rowlinson, 1997).

National/Cultural Clashes

The most important theme in modern times is that the universal recognition that culture exists (Ankrah, 2007). Hofstede's (1983) cultural dimensions theory expresses the effects that a society's culture has on the values of its members and how behaviours relate to these values. Different cultural backgrounds may influence behaviours on site and could potentially cause cultural clashes leading to unsafe systems and acts; although management itself has been considered a more important determinate of behaviour at work than national culture (Mearns & Yule, 2009).

Risk Perception

General hazard/risk perception of construction workers has been found to be far from ideal (Carter & Smith, 2006). This could be a significant issue as if one does not recognise there is a risk, then one may not act appropriately. Fluctuation of risk perception amongst individuals makes it difficult to identify the causes, effects and prevention techniques for risk-taking behaviour (Haines et al., 2004).

Risk Taking and Thrill Seeking

Sensation/thrill seeking and risk taking have a strong correlation (Zuckerman, 1994). Sensation seekers take risks purely for a thrill factor rather than any other reason. Those that scored highly on the Zuckerman's sensation seeking scale (Zuckerman, 1994), a validated psychometric test, have been found to be related to higher accident rates (Bierness and Simpson, 1988).

Sleeping Pattern/Tiredness

An alteration to sleep pattern or a lack of sleep could affect awareness and alertness, which could increase the chance of an accident. This could be linked to the use of alcohol or drugs, a shift change, clocks phase change or a return from a holiday period. While one study (Holland & Hinze, 2000) found no statistical evidence between accident rates and clock phase advances, another significantly larger study (Barnes & Wagner, 2009) established that following phase advances employees had 40 minutes less sleep, 6% more accidents and lost 68% more working days, than on non-phase change days. These findings were based on mining injuries between 1983 and 2006 – comparing the Monday after the phase advance with other days.

Safety Culture

The term "safety culture" first appeared in the 1987 OECD Nuclear Agency Report following the devastating Chernobyl disaster in 1986 (Cox & Flin, 1998). A 'poor safety culture' has often been identified as contributory factor in accidents, including high profile disasters such as the Kings Cross Fire (ACSNI, 1993). Safety culture is essentially a subculture of organisational culture, where the three levels of organisation culture (artefacts and behaviours, espoused values and assumptions) (Schein, 2004) can equally be applied to safety culture (Whittingham, 2012). Though this factor is widely publicised as being very important, few authors have been able to pin-point exactly what its influence is, let alone quantify it. Further research and theoretical modelling is required to fully determine its significance.

Summary: A Safety 'Equation'

A combination of all these behavioural factors will potentially create a very complex safety equation on site, with behaviours influenced by some factors more than others, at different times and in different situations. These factors have all been highlighted within previous safety literature, and their relevance within a large multinational workforce was explored, in order to establish their perceived influences in practice.

RESEARCH METHOD

This study has three phases. The initial literature review, above, has informed on the likely factors as identified in previous research. The next phase was to take advantage of an existing 'management safety climate survey' that had already been established on the project. The third phase was closer examination of the attitudes of the workforce to the factors identified through the literature and the survey via a focus group. The safety climate survey is completed by the vast majority of project workers, office staff and site operatives, on a given day, taking a 'snapshot' of the site. Additional questions were included within the standard project survey by the research team to enable further exploration of the workforce perceptions of the behavioural safety factors identified within the literature.

Restricted by the delivery mechanism of the survey, a four point Likert attitude scale was used to examine 'which factors contribute to on-site accidents?'. Factors could only be presented as headings with no further clarification or explanation as to their content. Although the results from the survey are therefore limited to the respondents own understandings of the factors, and which cannot themselves be further explored through this mechanism, they are arguably able to support further directed investigation by providing an indication of the perspectives of the workforce.

Following the survey more fine detailed understanding was developed via a focus group, which consisted of four employees working on the project: a safety advisor, two works managers from different departments and an operative. The focus group examined ten safety-related case studies (photographs and descriptions) through the findings of the survey, seeking to reinforce and further examine the factors as they related to practice through the perceptions of the group members. The group comprised of two stages, firstly each participant individually determined if the factors were 'likely', 'could be' or were 'unlikely' to be influencing safety behaviours in each of these case studies presented, if the participants felt that from the data provided they were not able to comment, there were able to select a 'not possible to tell' option. After this task was completed, the group then discussed the case studies collectively, and came to a general consensus of the influence of the factors on the case studies presented.

SURVEY FINDINGS AND ANALYSIS

The survey was completed by n=475 respondents. Key sample characteristics are that 92% were male, 55% considered themselves to be labour force, 45% supervised others, and 38% had worked less than 6 months on the project.

Respondents could assign 'always', 'sometimes', 'rarely' or 'never' to the presented factors in terms of their perceived contributions to on-site accidents. Safety culture, risk taking, experience/training and poor risk perception were the most prominent factors, felt to 'always' contribute to on-site accidents. A notable result was the perceived prominence of alcohol and drugs to 'always' be a factor in accidents,

possibly suggesting that there is a strong alcohol and drug culture on the site or in wider industry. National/cultural clashes were least likely to 'always' be a factor in on-site accidents, potentially surprising given the multinational nature of the project and its workforce, but also possibly reflecting a harmonious site where this factor is not considered as a safety consideration at all.
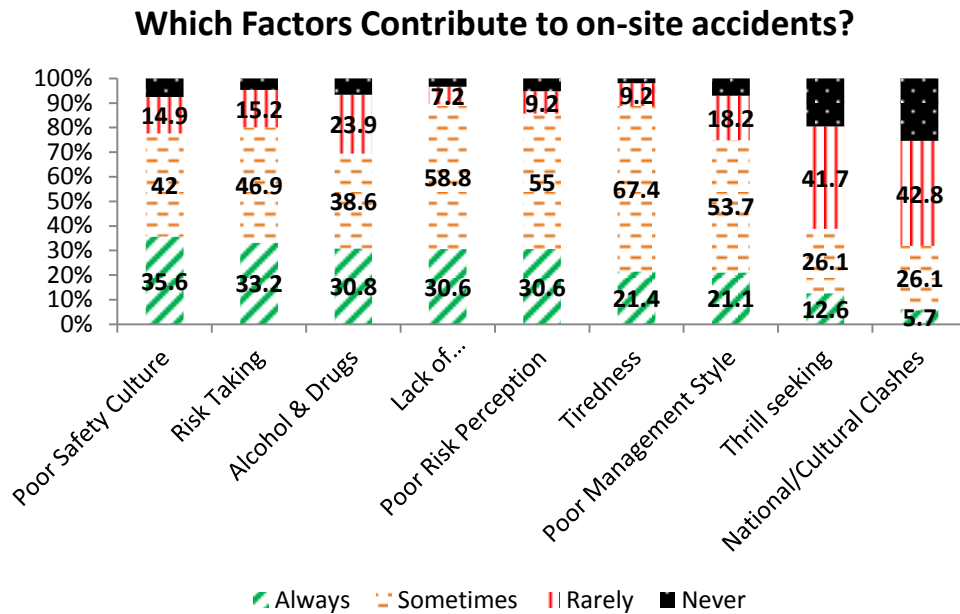
Which Factors Contribute to on-site accidents?

Figure 1 Survey Results

Further survey analysis was undertaken in order to draw out the factors that were felt to be most relevant in their contribution to on-site accidents. A score was assigned to each category (always=3, sometimes=2, rarely=1, never=0), and although this four-point scale does not correlate exactly to a linear scale, it can be used to give an indication of the most important factors. The graph below gives a total of the scores in each factor:
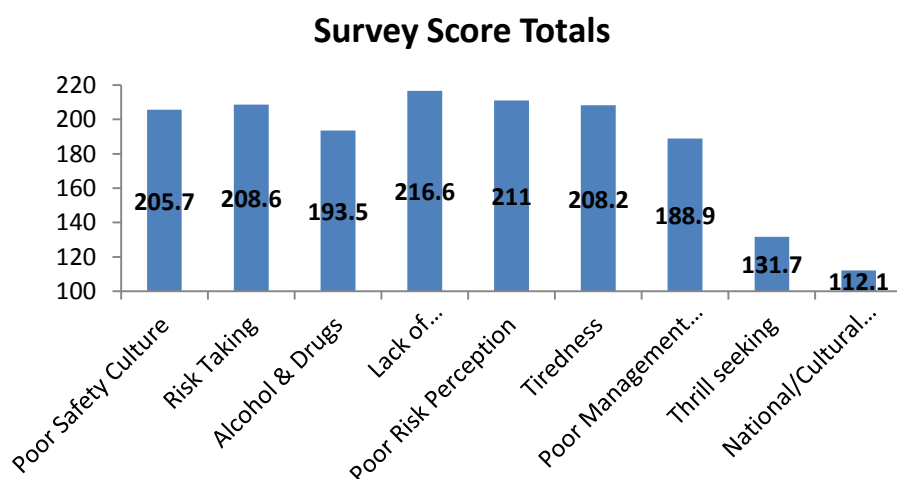
Survey Score Totals

Figure 2 Ranked Survey Results

A shift in the overall rankings of each factor can now be seen when compared to the Figure 1. Thrill seeking and National/Cultural clashes are still the two least influential factors, whilst lack of experience/training has now become the most significant

contributory factor. This ranking now indicates that: lack of experience/training, poor risk perception, risk taking, tiredness and poor safety culture are the factors with the highest (217 - 205) contributory influence to on-site accidents. Alcohol and Drugs and poor management style are factors with moderate (194 - 188) influence, whilst thrill seeking and national cultural clashes have the lowest (132 - 112) influence.

Addition and Amendment of Factors

In the processing and analysis of the survey results, it emerged that some participants had been motivated to include factors of their own, writing them on the survey unprompted. This act, combined with informal discussions with survey participants post completion, led to the additional of the following factors: 'age', 'gender', 'design' and 'time pressure'. These new factors were consequently taken back to the literature, and explored further.

Age has been highlighted in investigations seeking a correlation between age of workers and accident rates. However, the findings from such studies have tended to be contradictory with no fixed conclusions (Laflamme & Menckel, 1995). Some studies have concluded younger workers (Lin, Chen, & Luo, 2008) are more accident prone, while others have deemed older workers are (Charg-Cheng et al., 2007). Despite there being contradictions in conclusions, there is one generality: the greatest number of accidents occurs in either the younger or older workers. Gender has also been considered in health and safety research as a contributory factor; Lin, Chen and Luo (2008) found that male workers had a much higher occupational fatality rate than female workers (7.4 compared to 0.9 per 100,000 full time workers).

The influence design has on accident causation has been well documented (for example Donaghy, 2009) and hence the existence of legislation such as the Construction Design & Management regulations in the UK (CDM, 2007) which places duty on designers to eliminate and reduce risk at the design stage. Szymberski's (1997) conceptual model hypothesises that the ability to influence safety is reduced through each stage of the project schedule.

Time Pressure as a causal factor has been identified in several studies. A case study in Hong Kong reported that the tight construction schedule was the most serious factor affecting construction site safety (Ahmed et al., 1999). Another study found that production bonuses can cause unsafe acts (Sawacha et al., 1999), while Langford et al. (2000) state that supervisors knowingly ignore unsafe acts due to time pressure set by agreed upon programs.

Following this analysis, 'experience' and 'training' were also separated into two factors as they were deemed not to correlate closely enough to be combined as one factor.

FOCUS GROUP FINDINGS AND ANALYSIS

A revised factor list, developed from the literature and survey findings, was then employed within a focus group analysis of ten safety-related case studies, in order to appraise the potential contribution of the factors to the safety issues illustrated in the case study material.

Initially, the group were asked to individually consider the factors and their potential influence within the case study examples. The results from this individual consideration can be seen in Figure 3:
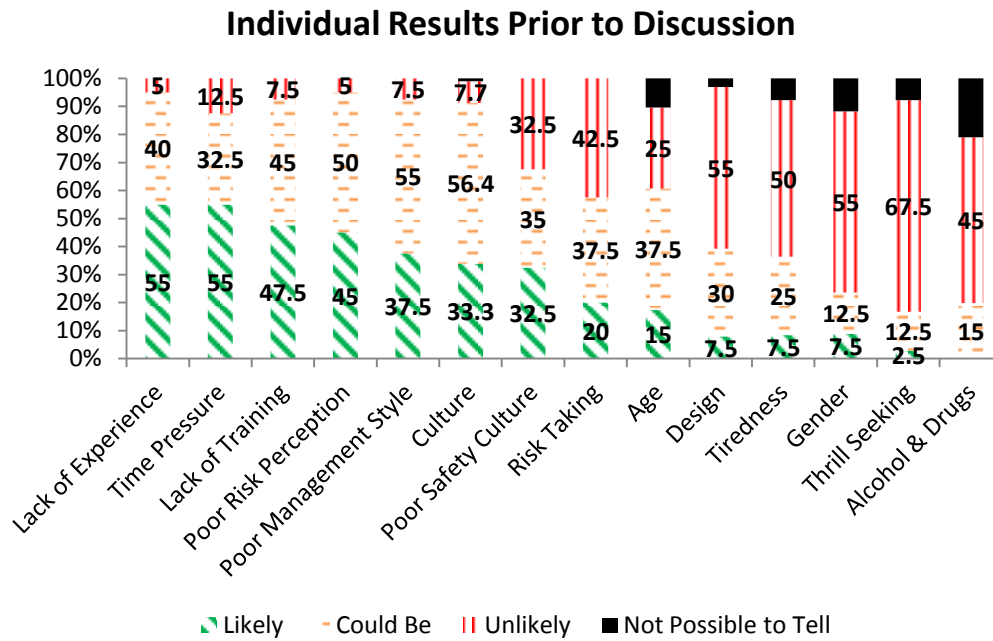
Individual Results Prior to Discussion

Figure 3 Focus group results prior to discussion

Upon completion of the individual assessments, a group discussion was undertaken and collective agreement reached:
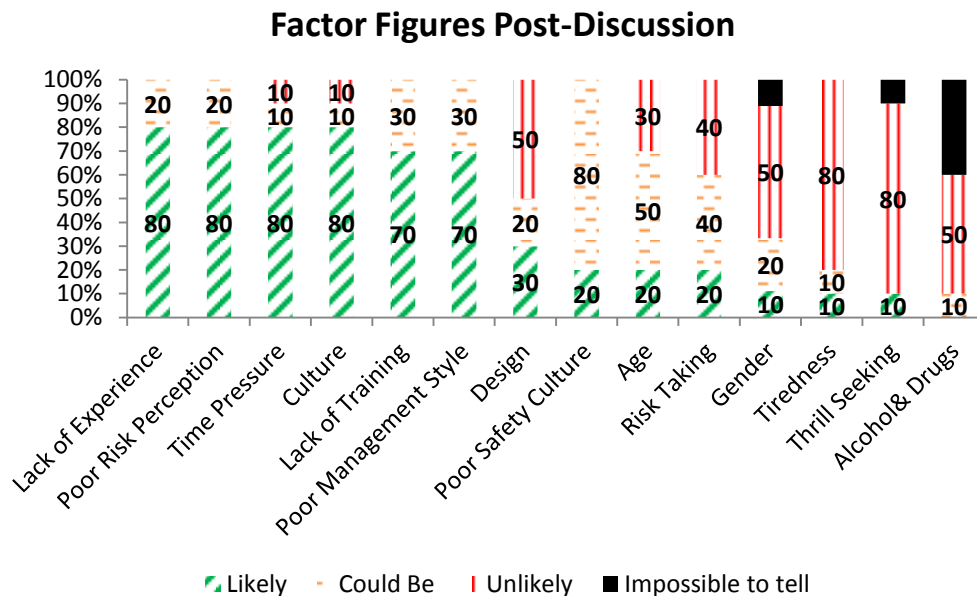
Factor Figures Post-Discussion

Figure 4 Focus group results post-discussion

Following the focus group discussion, there was an overall reduction in the 'could be' allocation of the factors, a decrease of 44% overall, as participants were swayed one way (likely) or another (unlikely) by other members of the group. Most of the factors increased in the "likely" category by between 30% and 90%. The greatest increase was in design (433%), which was often due to a design change that the majority of the group hadn't considered in their individual appraisals, but once they had been enlightened by another participant they altered their assessment. Safety culture was the only factor to decrease, although only by 8%. Safety culture also had the highest

'could be' allocation, potentially this was due to the information provided for the case studies from which it may be difficult to disclose whether it was a factor or not. Furthermore this factor is itself highly subjective, although the group did acknowledge that in many of the case studies it 'could be' an influence. Time pressure, a factor developed from the survey findings, was considered to be a very important factor by the focus group. Participants stated 'we all want to save time by taking risks'; 'it is time nowadays, everything is time'; 'we are having to put things together as a budget and a cost and we are cutting it too fine to be fair. We are not given enough time' and 'here we go again, it is time. Time is the first one [factor] guaranteed'. This was a recurring theme throughout the discussions and positioned this factor as a key influential factor in safety issues on site. The top six factors that were defined as 'likely' by the panel to contribute to a safety issue in at least 7/10 case studies were experience, risk perception, time pressure, culture, management and training. Although the survey findings suggested that direct national/cultural clashes were very rarely a factor in an accident, the focus group results imply that culture is an influential factor in accidents. In two case studies, laziness was also suggested.

DISCUSSION

The prominence of safety culture within both the survey and focus-group findings, and its perceived influence as a factor in on-site accidents, suggests that this is a factor that merits further exploration. Indeed, safety culture can be seen as the summation of all other factors in practice, and it is proposed that this factor is further explored in detail, including examination of what this term means to the workforce themselves as a collaborative aspect of the project. The survey findings when ranked suggest a more individual and tangible consideration of the influential factors in accidents. Tiredness, risk taking, lack of experience/training and poor risk perception are all practical characteristics of the individual at work. Risk perception within the industry workforce has been identified as far from ideal (Carter and Smith, 2006), something the workforce themselves seem to acknowledge. Experience scored very highly in the focus group as well as the survey suggesting that the workforce agree with Fang et al. (2004) that human experiences influence safe or unsafe acts. A surprising result was that 31% of participants thought that alcohol and drugs were 'always' a factor in accidents. This could suggest an alcohol and drug culture within the project workforce, or even in the wider construction industry as the findings in Biggs & Williamson (2012) indicate that there is an alcohol and drugs culture within the Australian construction industry. The focus group found it difficult to conclude if alcohol and drugs were a factor from the case study information provided. It was not deemed to be 'likely' a factor in any of the case studies but the group agreed it could have been a factor in one case study, where an incident had occurred early in the morning on return from the Christmas holidays. Again, this is another factor that merits further examination. Perhaps the most important factor however was time pressure, it was suggested unprompted by the workforce as worthy of consideration, and was often regarded as the most important factor by the focus group. The evidence from this research and a case study in Hong Kong, (Almed, 1999) that revealed a tight construction schedule was the most serious factor that influences safety, perhaps indicates that the time pressure factor is not just restricted to a particular country or continent. Laziness was identified in the focus group, by the group's own accord, in two out of the ten case studies. From an investigation into the literature after this suggestion, a case study in Thailand (Aksorn & Hadikusumo, 2007) found laziness to be an important factor in the unsafe act of leaving nails or sharp objects in dangerous

locations. From the findings, the factors have been grouped into four categories, from very high to low influence in on-site accidents, and therefore behavioural safety:

VERY HIGH: Time Pressure

HIGH: Culture, Experience, Management, Risk Perception, Safety Culture, Training

MEDIUM: Alcohol & Drugs, Age, Design, Tiredness, Risk-Taking

LOW: Gender, Laziness, Thrill-seeking

CONCLUSIONS

Through a critical analysis of the literature potential factors that could influence the behavioural response of an individual to hazards have been identified. The combination of results from the questionnaire survey and case studies considered by a focus group suggests that time pressure, training, experience, risk perception, safety culture, culture and management are the factors perceived to be most likely to influence the behavioural responses. When identified as a factor, time pressure was often regarded as very influential. Perhaps the most surprising conclusion was the survey results suggested that alcohol and drugs was such an important factor. The findings indicate that safety culture, which could be seen a summation of all the others factors, is an important factor despite an acknowledgement from the focus group that, with the information provided, it was difficult to interpret. Hence alternative methodological approaches will be explored to investigate this factor further, and the others outlined. It is anticipated that fine-grained, observational analyses will yield significant insight as to safety the influence of these factors in practice, and in order to accomplish this, an ethnographic participant observer approach is to be employed. Results of these further investigations will be reported in future ARCOM conferences.

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