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An investigation of lifting operations on UK construction sites

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ABSTRACT

Lifting operations and associated equipment have become commonplace within the UK construction industry. However, recent high profile accidents involving lifting equipment have shown that the result of its misuse can have serious cost and health implications.

The main aim of the research was to investigate lifting operations on construction sites exploring different options, their effectiveness, and their effect on safety. This research looked into the processes in place; the factors that have to be taken into consideration when placing and using lifting equipment; and the competent persons required when operating equipment. With these aims, literature review was conducted. This was followed by investigation on three construction sites. These case studies were enhanced through interviews with general site staff, managerial staff, and appointed persons.

The findings revealed six main points to improve safety in lifting operations. These are: through planning; training; equipment selection, use and inspection; feedback/communication; appointed person's role; and database. Thorough planning of lifting operations has positive effects on safety. There is need for tighter accreditation of all qualifications in the lifting operations field. The charter of major lifting equipment from specialist contractors should be considered as industry best practise. Companies should avoid authoritarian working culture to facilitate efficient feedback to improve safety. The appointed person should have site based role. Site inspections and maintenance should be monitored on a national database form.

Practitioners can benefit from this paper as it provides information on experiences from three construction sites. Furthermore, researchers can use the findings for their future studies.

1. Introduction

The construction industry in the UK is one of the safest in Europe (Contract Journal, 2008). Despite of this fact, there are major accidents with fatal consequences on a regular basis. The increase in construction activity countrywide has also provided an added interest in this subject area. The increase in construction activity gives the potential for an increase in lifting equipment related accident frequency. For this reason this study focuses mainly on lifting operations on UK construction sites in order to reduce the risk of emergence of lifting equipment related accidents.

2. Literature review

The industry's financial and timescale constraints imposed by the client have forced a change of methods and materials throughout construction. As Shapira et al. (2007) emphasize, today's construction projects are highly mechanised and the working environment is dominated by material handling and lifting equipment. The change to an increased dependency on mechanical operations has led to changes in health and safety. As Neitzel et al. (2001) emphasized, today's industry "*involves complex and dynamic work environments that present new hazards to workers*". Manual transfer of materials are said to cause most minor accidents whilst mechanical transfers most of the serious accidents (Perttula et al., 2003). "*One of the major causes of fatalities during construction is the use of cranes or derricks during lifting operations*" (Beavers et al., 2005). The Crane and Hoist Safety report prepared by OSHA (1996), found a death rate of 1.4 deaths per 1000 operators over a 45 year working lifetime (Neitzel et al., 2001). Cranes are the most common form of lifting equipment seen on UK construction sites, because they are the most adaptable and productive equipment in use (Hanna and Lotfallah, 1999).

A lifting operation is defined as "an operation concerned with the lifting and lowering of a load" (LOLER, 1998). Lifting operations are considered both complicated and dangerous processes. In a press release in July 2001, the Health and Safety Commission (HSC) made particular reference to the construction industry's problems, with two deaths every week and a fatality rate of six people per 100,000 workers (HSC, 2001). A further study conducted in 2004 found that of the 4624 incidents reported to the Health and Safety Executive (HSE) during the period of 1st April 1998 and 31st March 2003, 861 incidents occurred during a lifting operation (HSE, 2004).

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Causes of accidents in lifting operations include: human error (Beavers et al., 2005); failure of equipment (Beavers et al., 2005); types of equipment (Beavers et al., 2005); instability, lack of communication; and lack of training (Yow et al., 2000). As Beavers et al. (2005) stated, human error is the cause of almost 60% of lifting operation related accidents. A further problem is that over 30% is down to the failure of equipment (Beavers et al., 2005).

The selection of equipment can have effects on the effectiveness and efficiency of the site, depending on how well the equipment is suited to its environment. The literature review would suggest that there are two depths of equipment planning, rigorous and intuitive. The selection of cranes often has a relationship with the types of potential accidents that may occur (Beavers et al., 2005). The factors affecting the selection of cranes are: site specific requirements; culture; cost; and availability (Shapira and Glascock, 1996). From 1st January 1997 to 31st December 1999, the Division of Occupational Safety and Health learned of, or had reported to it, a total of 158 accidents involving a crane (Yow et al., 2000). As Yow et al. (2000) reported, the types of cranes in all these accidents are as follows: Mobile cranes (73% of the accidents); bridge cranes (16% of the accidents); gantry cranes (3% of the accidents); tower cranes (3% of the accidents); ship cranes (1% of the accidents); and not determined (4% of the accidents).

The accident rates can be reduced through usage of safety devices and by legislation. The safety devices introduced to cranes and other lifting equipment can be put into one of five major categories: Anti Current devices; Anti Upset devices; Operator and Rigger Protection mechanisms; Anti Collision devices and other safety devices which include hooks with safety latches (Neitzel et al., 2001). Legislation has looked to improve safety standards, and the HSE and HSC introduced several changes, including specific legislation covering lifting operations and accident reporting. The introduction of specifically designed legislation, including the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) and the Construction Design and Management Regulations 2007 (CDM), controls the use of all lifting operations and associated equipment. The figures show that the new regulations are working, as in 2006, the year prior to the CDM regulations revision 88 fatalities were recorded, and four years on that number had dropped to 70, which was the lowest for 20 years. Since the introduction of the LOLER regulations accidents involving lifting operations have decreased by over 31% (HSE, 2004).

Literature on construction equipment mainly focused on: innovations (Arditi et al., 1997); equipment economics for building construction (Selinger, 1983); the history of equipment for earthmoving operations (Douglas, 1975; Klump, 1975; Larkin and Wood, 1975; Tatum et al., 2006a,b); culture affecting selection of mobile cranes (Shapira and Glascock, 1996); selection of cranes (Hanna and Lotfallah, 1999); cranes/history (Shapira et al., 2007); selection of mobile cranes (Shapira and Schexnayder, 1999); crane related fatalities (Beavers et al., 2006); crane safety (Neitzel et al., 2001); and accidents in material handling (Perttula et al., 2003). This research contributes to the investigation of lifting operations on construction sites by exploring different options, their effectiveness, and their effect on safety. This research investigated the processes and the factors taken into consideration when placing and using lifting equipment; as well as the competent persons required when operating equipment on site. In this way, the research distinguishes itself from earlier studies by establishing practical recommendations and interview questions tool.

3. Methodology

Case studies were carried out to show the differences in the planning and selection methods that surround lifting operations and how different sites consider different equipment depending on their materials, the surrounding area, the construction method and how the safety of lifting operations is considered and appraised on site. The aims of the case studies were to investigate the difference in opinion between different personnel on the safety of lifting operations on the site, and how opinions differ depending on the roles, levels of responsibility and interaction with the lifting equipment.

Table 1
Details of interviewees.

	General site staff	Managerial staff	Appointed persons	Total
Case one	3	2	1	6
Case two	2	1	2	5
Case three	2	3	1	6
Total	7	6	4	17

Case study one was conducted on a residential apartment block in a rural area of Wirral. The project value is £2 931 000 and will be constructed using typical brick and block housing methods. On completion it will stand at 13.5 m high. Construction is scheduled to take 13 months.

Case study two involved the construction of a canal and public seating area in Liverpool City Centre. The project value is £11 000 000 and is scheduled to take 20 months. The project is at 4 m below ground level, and will be constructed using site poured concrete.

The third case study involved a steel framed apartment block in Chester City Centre. It is a 20 months project that is valued at £5 100 000. The completed block will stand at 16.85 m.

Once the case studies had been performed, interviews with site personnel were conducted, to qualify the findings. All interviews were semi structured in order to enable the interviewee to express his opinion and to get as much information as possible. The interview stage was broken into three sections. Seventeen persons were interviewed across the three areas that included general site staff; managerial site staff; and appointed persons (Table 1).

3.1. General site staff interviews

The aim of the general site staff interview was to collect data from persons interacting with equipment, who are heavily involved in the delivery of lifting operations on a day to day basis. The questions focused on qualifications; dangers of equipment; and causes of accidents.

3.2. Managerial staff interviews

The aim of the managerial interview was to investigate the personal opinions of managerial staff on qualifications, dangers of equipment and accidents, which would provide an insight into common factors and differences between managerial and general staff perceptions. The second section of the interview looked at the planning; selection; and use of lifting equipment on site, to examine the processes in place and their effect on the sites performance.

3.3. Appointed persons interviews

The appointed person's interview aimed to collect recommendations and opinions on a site and industry basis from the lifting operations specialist. This provided explanations for selection of equipment, as well as areas that require change or further investigation.