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Causes and Solutions of Construction Crane Accidents in Malaysian Construction Industry

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Abstract

Construction industries play a significant role in contributing to the economic growth of a country. It provides job opportunities to all parties involved in the construction and operation of the building. However, it has one of the highest fatalities and injuries rate among the main economic sectors in Malaysia. This is because all processes in a construction project is extremely hazardous especially projects involving construction cranes. The aim of this study is to determine the causes and solutions of crane accidents in construction industry. The results gathered from the questionnaire shows that the main causes of crane accidents are safety management failure and in-depth training for operators and signalman is the solution for it.

Keywords

Construction industry, construction crane, causes, solutions.

Introduction

Construction cranes are machines that is used to lift and move heavy machineries and goods to a higher elevation in construction sites. Machines such as tower cranes or mobile cranes are being used all around the world in construction sites. Urban constructions may even have multiple tower cranes working at the same time to deliver heavy loads up vertical distances for construction projects. Stacking up with various factors that result in additional risk to using construction cranes, the risk of using construction crane poses a possible hazard to the people around it. To overcome these, the industry has started practicing health & safety to decrease chances of accidents occurring. However, even though the high risk in using construction crane is the field of construction is high. Neitzel (2001) opined that given the current available cranes, the potential for loss of property and life at construction sites is great especially without any planning and safety procedures. Further backing that up, Zairani (2020) also suggest that if these cranes are not given the proper care to maintenance and operations, damages to human life and property will occur.

This research focuses on the construction crane and the hazards that may be faced by contractors when they are using it. Zairani (2020) revealed that there has been construction accident caused by crane operation every year. Construction crane accidents that occur in construction projects can cause project delay, tarnish the reputation of the contractor and cause

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heavy loss to contractor. If crane accidents do occur on site, it is very often the project may face potential delay and in turn cost overrun. As cranes are very heavy and complex machineries, depending on the severity of an accident, it may be catastrophic to the progress of a project. An example is if a crane faces total failure and the crane collapses, it will take the contractor high cost to remove the debris of the crane off site. It may also damage the material or building and further costing the contractor to ensure the project is not delayed. Zairani also states that the crane accident effect will increase the maintenance, improvement and internal cost of reconstruction for the contractor (Zairani et al., 2020).

Moreover, crane accidents will also tarnish the name of the contractor. As allowing accidents such as these to occur will call into question the contractor's ability to plan a construction project, it may result in the contractor having less work as result of a bad reputation. As stated by Asanka and Ranasinghe (2015), this is will give the image of contractor having little control of the construction site and covering up by exerting pressure on employees to increase efficiency to catch up to deadlines. This is a dangerous move if such rushed employees are hurt due to being rushed (Asanka and Ranasinghe, 2015).

Lastly, Crane accidents will result in heavy cost to the contractor. Among the list of cost that will be incurred onto the contractor are medical compensation, material replacement, machine replacement, possible litigation and furthermore. All these costs can stack up and cost the contractor a big sum of cash. Depending on the severity of an accident, it can easily go up to millions in damage. Research done in Singapore shows that the average insured accident costs, uninsured accident costs, and total accident costs of building projects account for 0.15%, 0.1%, and 0.25% of contract sum, respectively. This finding implies that the accident costs are substantial for contractors and that potential savings could be achieved by preventing the occurrence of construction accidents (Teo and Feng, 2011).

The objectives of this study are to investigate the main causes of crane accidents in Malaysia, and to propose solutions to crane failures and accidents through analysing past experiences of contractors.

Causes of Crane accidents

Operational and Technical Failure

One of the main causes of crane accidents is the structural failure of the construction crane. Zairani provided his insight in operational and technical failure, he says that these elements are normally due to the structural failure and the mechanical failure of the crane components. (Zairani et al., 2020)This could easily result in loads being dropped or the complete structural failure of the crane causing it the fall.

Human factor

As tower cranes are being operated by humans, there is always a human factor which may cause accidents. These can be the result of negligence of the employee to focus on health and safety during work and is one of the main causes of construction crane accidents. The statement provided by research done by Zairani says that the most severe negligence in the accident is lifting excessive weight that was higher than the maximum load capacity. (Zairani et al., 2020)

Safety management Failure

Safety management is important for contractors as it is there to educate and ensure all employees understand the tower crane and its operations clearly. Failure to manage this safety can result in health and safety being compromised and create a dangerous work environment. Furthermore, safety management also includes maintenance and regular inspection of the tower crane to ensure no parts degrade over time. Further supporting this, Zairani has found that around 2018-2019 In Malaysia, around 500 crane operators unregistered and not have a competence license and operate the tower crane, as required by DOSH. (Zairani et al., 2020)

Environmental conditions

On the other hand, hazardous and weather conditions also become one of the environment causes that contribute to crane accidents. (Zairani et al., 2020) Fei S also concluded that one of the most prominent issue due to environmental conditions is the crane operator's low visibility during lifting operations. (Fei S, 2018). Environmental conditions are hard to plan for and is a very big issue when handling construction cranes.

Solutions to reduce crane accidents

Cranes should be inspected and maintained before use

As construction cranes are complex and heavy machinery, regular inspection and maintenance should be carried out to ensure the crane is in top condition. The inspection and maintenance should be done by a professional as suggested by the guideline for constructional safety by DOSH (2007). Furthermore, inspection should also be carried out before any lifting works begin to ensure all parts are secured tightly and safely. This is ultimately important as construction cranes are more prone to failure when lifting works are underway. Construction cranes which are not properly maintained by the contractor are more likely to see certain part failure during lifting works. An example is the hook block falling down when lifting works begin, possible injuring and killing any worker unfortunate enough to be hit by it.

Human competence

The operator of construction cranes are mandated by DOSH to have professional training and license before he/she is able to operate such cranes. Most crane operators will be normally accompanied with a signalman to aid him during lifting works. The job of the signalman is to act as the 2nd eye for the construction crane. Signalman is responsible to give clear signals as a mean of communicating with the crane operator after rigging is completed and the load is ready to be lifted (Idris, 2017). He/she needs to cooperate with the crane operator during lifting works and call out any dangers or stopping the crane operators when any dangerous situation is found.

Care regarding locations of tower cranes and its foundation

Most contractors are adept in choosing a suitable location that is perfect for lifting for construction cranes in a construction site. If there isn't a need to, most contractor will try to employ a tower crane in areas where it can generally reach multiple locations without the need to relocate it often. However, sometimes locations such as these will not have a suitable foundation for the tower crane. It is important for contractors to not only look at the efficiency of a location for a tower crane, but also its foundation. Furthermore contractors also need the contractor to look at possible nearby hazards towards operator of the construction cranes, any live electrical wires near the tower crane should be avoided as best as possible.

Use of radar and camera technology

One of the most simple and innovative ideas to come out is the hook crane camera. As busy urban areas require more accurate and easier to use anti-collision and safety equipment to ensure a safe working site (Technology and Innovation In Tower Cranes, 2022) the hook crane camera has been developed. It is a technology which allows the crane drivers to observer the cranes location from the driver cab and allow for better depth of view when driving and moving materials with the crane. It has started being widely used in construction sites in the United kingdoms and greatly reducing the number of construction crane accidents.

Use of 3D lifting software

Another recent technology is 3D lifting software for mobile cranes. Using computer simulations, such software are able to design and control lifting plans for mobile cranes that are efficient both cost and time wise. (Han, Bouferguene, Al-Hussein & Hermann, 2017) However this technology isn't as widely spread as awareness about it has not risen to great amounts. But, the theory for the software is solid and the author can see it being a contractor's must have tool in their arsenal. Furthermore, software for location optimization for tower cranes are also beginning to spread in the construction industry.

Methodology

This research was carried out through the quantitative method. The primary data was collected through online questionnaires whereas the secondary data was collected from journals to support the research. Quantitative method was used to collect opinions for the key questions of the research. The questionnaire was distributed to 70 contractor firms in Selangor and only 50 has replied. The statistical tools used for the data analysis were mean score method and T-test.

Data Analysis

Objective 1: To investigate the main causes of crane accidents in Malaysia.

Table 1. Analysis of Causes

Causes of Crane accidents	Score					Total Number of Respondents	Mean Score	Rank	T-test
	1	2	3	4	5				
Safety management factor	0	2	6	13	29	50	4.38	1	11.419
Human Factor	0	3	6	30	11	50	3.98	2	9.011
Technical and Operational Factor	0	4	30	8	8	50	3.40	3	3.299
Environmental factor	5	29	7	5	4	50	2.48	4	-3.425

Note: T-test critical value = 1.67655

Objective 2: to propose solutions to crane accidents

Table 2. Analysis of Solutions

Causes of Crane accidents	Score	Rank	T-test

	1	2	3	4	5	Total Number of Respondents	Mean Score		
Operators and Signalman require more in-depth training	0	0	3	7	40	50	4.74	1	21.792
Cranes should be inspected and maintained by a professional	0	0	5	17	28	50	4.46	2	15.262
Employers should Employ safe working procedures	0	6	8	13	23	50	4.06	3	7.086
Crane lifting locations should be given more care when choosing	1	6	22	12	9	50	3.44	4	3.133
Equipping cranes with radar/cameras to reduce collision	4	15	13	11	7	50	3.04	5	0.237
Use of new 3D technology to simulate lifting software for cranes	16	9	13	5	7	50	2.56	6	-2.219

Note: T-test critical value = 1.67655

Conclusion

The main cause of construction crane accidents is safety management failure. It shows that management planning and decisions are above all other causes of crane accidents. Whereas the most significant solution is in-depth training of crane operators and signalman. This is closely related to safety management by ensuring more staff and workers are trained for safety and health in relation cranes on site. This research is limited to 'causes and solutions' of crane accidents and only targeted Selangor region.

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