

Towards Zero Accidents in Construction Projects: Promoting HIRARC As An Effective Tool To Reduce Accidents

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Abstract— The construction industry contributes significantly to Malaysia's economy, and yet construction projects are highly risky and hazardous to all walks of life. Accidents occurred in construction site is higher compared to the other industry. The Malaysian government has been giving vigilant attention and constructive efforts to reduce accidents on construction site due to its alarming fatality rates. DOSH particularly has given their highest attention to the implementation of safety management on construction projects, in the hope of achieving a zero accident industry particularly for construction. HIRARC, or known as Hazard Identification, Risk Assessment and Risk Control has been made compulsory for construction projects exceeding over the costs of RM 20 million. This paper has been done to introduce HIRARC, illustrating its concept affiliated with Domino Theory, and exemplified its effectiveness in reducing accidents by comparison based on projects. In the end, the findings show that governance of HIRARC in construction projects is actually effective in managing safety and reducing accidents on construction projects.

Keywords-HIRARC, Domino Theory, Construction Safety Management

I. INTRODUCTION

The construction industry considered being extremely dangerous, dirty, and difficult and exposing a lot of hazards and risks to workers. To cope with alarming accident rates in the construction industries, a comprehensive Occupational Safety and Health Act (OSHA) 1994 was introduced. OSHA 1994 is enforced by the Department of Occupational Safety and Health (DOSH) under the Ministry of Human Resources. Under OSHA 1994, a series of regulations have been introduced under OSHA 1994. These regulations have been urging the implementation of occupational safety and health (OSH) in workplaces. One of the regulations is Safety and Health Officer Regulations, which requires construction industry to appoint a Safety and Health Officer (SHO). HIRARC, or known as *Hazard Identification, Risk Assessment and Risk Control* has been implemented on construction sites as means of an effective safety management system to control risks and reduce accidents. In fact, HIRARC has been made compulsory for construction projects exceeding

over the costs of RM 20 million, implemented by accredited Safety and Health Officer under the governance of OSHA 1994. In the long run, the implementation of HIRARC will be a great tool towards achieving a zero accident construction industry optimistically.

II. BACKGROUND

Briefly, HIRARC comprises the procedure of Strategic planning, Hazard Identification, Risk Assessment, Prepare risk control action plan and periodically review. Under “strategic planning”, the management in the company establishes risk assessment team which includes workforce representatives and competent personnel within the organization. These personnel will be trained and briefed about their roles, objectives, and management's safety policy, and scope of the HIRARC. Periodically, all relevant essential HIRARC documents will be collected, and planned according to agreed methodology. During any assessment, action plan are prepared and collated for each evaluated and defined risk [1].

Construction specifically is widely recognized as one of the most hazardous occupations for those who work in the industry and significant source of accidents for members of the general public who are affected by the industry's work [2]. In construction sites, hazards can be categorized under health hazards and physical hazards. As some hazards may not be readily identifiable, it is vital to conduct hazard identification to find possible harms which will lead to accidents. Safety and health officer shall review all the work activities, and conduct hazard identification with “Brain storming method”, “Job safety analysis”, “What If analysis”, “Fault tree techniques and Accident investigation”.

Risk assessment on the other hand is a process of determining the probability level of the identified hazardous event, severity of the consequences of the hazard event, and finally to determine the risk level of an event determining the significance or value of the identified hazards and risks to the workers [3]. The methods for assessing risk include formal assessments, which can be qualitative or quantitative; or informal assessment done by a worker or the supervisor.

Following that, if the risks are considered to be intolerable, risk control action plan should be done to record any recommendation of control actions, and suitable program implementation. Eventually, risks can be reduced through corrective measures by means of program implementation, ranging from the options of elimination, substitution, isolation, engineering control, management control to the use of personnel protective equipment [4]. Finally, adequacy and effectiveness of the action plan shall be viewed periodically by the management to control the risks. To counter significant threat and uncertainty in managing safety, HIRARC should be carried out continuously.

III. AFFILIATION WITH DOMINO THEORY

Implementation of HIRARC is strongly affiliated with the basic philosophy of accident prevention model-“Domino Theory”. In “Domino Theory”, the occurrence of an injuries or fatal case is a result from a complete chronological sequence of five factors illustrated in figure 1 below [5]. The occurrence of injuries is a series of events, which invariably happens in this logical order. One is dependent on another, and hence is just like a series of dominoes placed on end in such alignment. Each domino represents each factor which is dependent on another. The fall in one domino eventually will precipitate the entire fall of the entire row.

If the series of this row of domino is interrupted by the elimination of even one of the several factors that constitute and causes it, hence the injury or accident will not occur [5]. By removing the third piece of Domino (unsafe acts or physical hazard factor) through implementing HIRARC on construction site is actually taking away one domino of the series, which will prevent the accident from happening. The mechanism of reducing accidents and preventing accidents affiliated with Domino Theory is illustrated as below at figure 2.

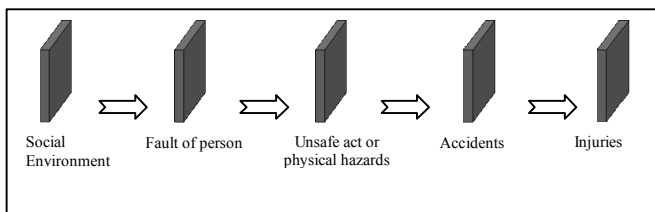


Figure 1. Domino Theory [Adapted from Source 5]

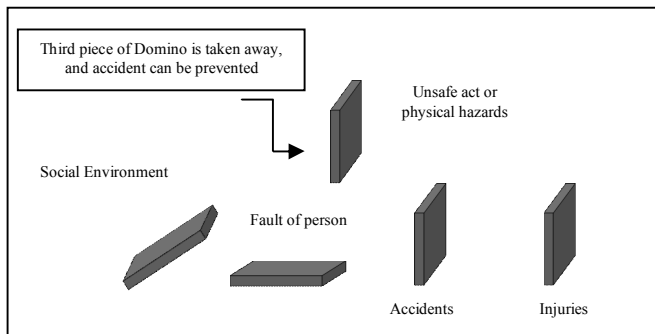


Figure 2. Domino Theory (Identify hazards with HIRARC)

Inadequate risk control and management causes accidents and it signifies management failure [6]. Studies showed that implementation of hazard identification and risk control in Hong Kong has reduced accidents drastically since 1986 [7]. Optimistically, by giving adequate attention and proper implementation of safety management, accidents at construction at construction sites may be avoided or minimized with the doctrine of HIRARC [8].

IV. METHODOLOGY

Safety performances of construction projects had been compared to exemplify the effectiveness of HIRARC in managing safety and reduce accidents on construction sites. Safety records of 6 non-HIRARC construction projects were compared with another 10 HIRARC construction projects. The projects sought for comparison were high-risk, and for standardization purposes, the status of these projects dated on 31st January 2008 was obtained, and all projects at least have reached physical completion. The background and the characteristics of HIRARC projects are shown in TABLE I, while non HIRARC projects are shown in TABLE II.

TABLE I. Projects with HIRARC

Project	Type of Project	Cost of project (RM Million)
A	High Rise	80
B	Office Building	15
C	High Rise	78
D	Sludge Treatment Facility	1.5
E	Immigration and Custom Center	1266
F	Commercial Centre	112
G	Factory	112
H	Shop Office	27.5
I	Shopping Complex	200
J	Petrol Station	1.57

TABLE II. Non-HIRARC Projects

Project	Type of Project	Cost of project (RM Million)
A*	Stadium	12.5
B*	4 Storey School	3.9
C*	High Rise	80
D*	High Rise	10
E*	High Rise	8.5
F*	Shop Office	4.9

V. RESULTS AND DISCUSSIONS

The effectiveness of HIRARC in reducing accidents can be identified by comparing the safety performance of projects with HIRARC, and projects without HIRARC. The average issuance of stop work order, average issuance of Notice of Improvement (NOI), average accident frequency rate, and average severity rate for HIRARC project and Non HIRARC projects are compared. The average number of these criteria will give a picture of the safety performance averagely and is portrayed in figure 3. From figure 3, it can be seen that HIRARC project averagely has a better safety performance compared to non HIRARC project. Non HIRARC project averagely has higher NOI (Notice of Improvement), stop work order, near miss, accident frequency rate, and severity rate compared to HIRARC project

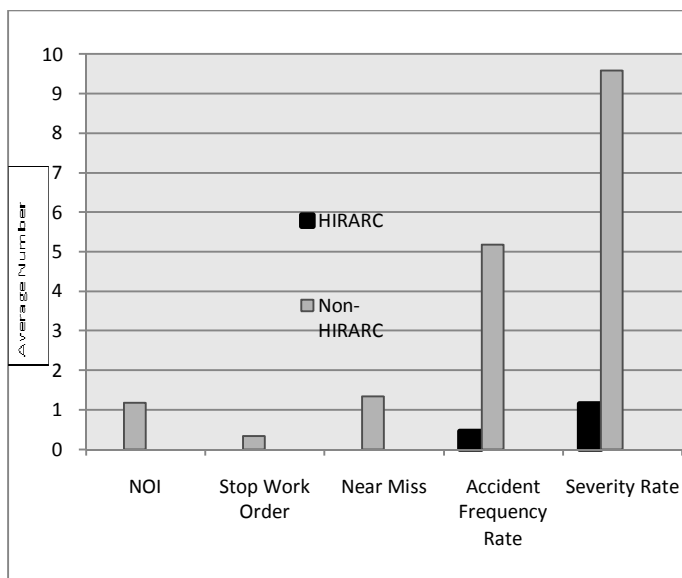


Figure 3. Comparison of safety performances between HIRARC and Non-HIRARC project.

VI. CONCLUSION

Monitoring a safety performance is very vital to see the effectiveness of the management system [5]. By comparing performance of HIRARC implemented projects with non-HIRARC implemented projects, and to see difference performance between them is one of the ways to identify the effectiveness of HIRARC. From the discussions above, it can be deduced that HIRARC is indeed effective in managing safety and reduce accidents in construction sites. By having a good safety management system such as HIRARC, the construction industry can strive for better improvement, redefine its image and steer itself in meeting a zero accident industry in near future.

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