

PREVENTION OF FALL ON CONSTRUCTION SITE

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Dedicated to...

Beloved abah, mama and family members

For giving me infinite love, care and blessing...

Assoc. Prof Aziruddin Ressang for his guidance

Thank you from bottom of my heart for being my inspiration

Lastly to my special one and also my dear friends,

Thank for your endless support to me...

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ABSTRACT

Construction industry plays an important role in improvement of any country's economy. Despite the contributions to economy, there are many accidents and fatalities happening in construction industry. Falling is one of the most frequent accidents on construction site. The research is to study causes of fall, factor affecting fall on construction site and to propose way to reduce construction falls. This research is done by reviewing published paper, journal and interviewing project participant; the severity and frequency of causes of construction fall on site and factor affecting them have been measured. Research conducted was formulated and distributed to project participant such as site engineer, safety officer, etc. The data collected have been analyzed using Cronbach's alpha (α): frequency rate, Mean Value, Relative Importance Index (RII) and Hazard Identification, Risk Assessment and Risk Control (HIRARC). The results showed the most frequency causes of falls are improper use of Personal Protective Equipment (PPE), slippery substances on surface, unsafe ladder and tools, weather condition, removal of protection measures, load handling and etc. Apart from that, the factor affecting construction falls are lacks of safety commitment among management team, lack of safety organizations which evaluate the safety level of design, and etc. Based on the result obtained, the proposed way to reduce construction fall is from administrative and management control, introduce of PPE, behavior control and engineering control.

ABSTRAK

Industri pembinaan memainkan peranan penting dalam peningkatan ekonomi negara. Walaupun industri pembinaan menyumbang kepada ekonomi, tetapi terdapat banyak kemalangan dan kematian berlaku dalam industri tersebut. Jatuh adalah salah satu kemalangan yang paling kerap di tapak pembinaan. Kajian ini adalah untuk mengkaji punca-punca jatuh, faktor yang mempengaruhi jatuh di tapak pembinaan dan mencadangkan cara untuk mengurangkan jatuh di tapak pembinaan. Kajian ini dilakukan dengan mengkaji semula kertas yang telah diterbitkan, jurnal dan menemuramah profesional yang terlibat dengan projek; keterukan dan kekerapan punca-punca kejatuhan pembinaan di tapak dan faktor yang mempengaruhi mereka telah dikaji. Penyelidikan yang dijalankan telah dirangka dan diedarkan kepada responden seperti jurutera tapak, pegawai keselamatan, dan sebagainya. Data yang dikumpul telah dianalisis dengan menggunakan 'Cronbach alpha' (α): kadar kekerapan, Min Nilai, Kepentingan Relatif Indeks (RII) dan Pengenalpastian Bahaya, Penilaian Risiko dan Kawalan Risiko (HIRARC). Keputusan menunjukkan punca kekerapan jatuh adalah penggunaan peralatan perlindungan peribadi (PPE) secara tidak berhemah, bahan-bahan yang licin dipermukaan, tangga dan alatan yang tidak selamat, keadaan cuaca, penyingkiran langkah-langkah perlindungan, pengendalian beban dan lain-lain. Selain itu, faktor yang mempengaruhi jatuh di tapak pembinaan seperti tidak mempunyai komitmen keselamatan di kalangan pihak pengurusan, kekurangan organisasi keselamatan yang menilai tahap reka bentuk keselamatan, dan lain-lain. Berdasarkan keputusan yang diperolehi, cara yang dicadangkan untuk mengurangkan kejatuhan pembinaan adalah daripada kawalan pentadbiran dan pengurusan, memperkenalkan PPE, kawalan tingkah laku dan kawalan kejuruteraan.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	FULLNAME
DOSH	Department of Occupational Safety and Health
HSE	Health and safety executive
HIRARC	Hazard Identification, Risk Assessment and Risk Control
ILO	International Labor Organization
NIOSH	National Institute of Occupational Safety and Health
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Association
PPE	Personal Protective Equipment
RII	Relative Importance Index
SOCSSO	Social Security Organization
SPSS	Statistical Package for Social Science
SMR	Standard Mortality Ratios
HF	Human Factor
LMF	Legislative and Management Factor
FCF	Financial and Contractual Factor

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Work safety is the basic guarantee for enterprises to realize their continued and stable economic development, and this is especially true for the construction industry, where safety must be a top priority. Despite the contributions to economic development, construction industry has always been blamed for the high rate of accidents and fatalities; this matter has placed the construction industry among the industries with unreasonable rate of accidents, disabilities and fatalities. (Abdul Rahim Abdul Hamid et al., 2003)

Although Regulations enacted and many hard workings have been done in order to decrease the rate of accidents and fatalities in construction phase such as Occupational Safety and Health (OSHA), statistics gathered by safety related organizations such as ministry of labor, Social security organization (SOCSSO), health and safety executive (HSE) and many others show unpleasant numbers of accidents and deaths and if not but very little improvement in safety and health compliance.

Reduction in number of accidents and fatalities is the ultimate aim of construction safety and health management in order to improve the overall performance of site activities that can reduce the risks of delay, cost, quality, labor turnover, and inefficiency and etc. Studies have been done that construction industry have become one of the most hazardous industries in many parts of the world and falls from height are a leading cause of fatalities in construction operations (Sorock et al., 1993).

Falls are a persistent hazard found in all occupational settings. A fall can occur during the simple acts of walking or climbing a ladder to change a light fixture or as a result of a complex series of events affecting an ironworker 80 feet above the ground. In Malaysian construction industry, even though OSHA strictly focused on falls and made revisions to the fall protection regulations workers' deaths due to falls from elevations has been shown to be persistently higher as compared to proportion to all deaths.

1.2 Problem Statement

Nowadays in construction industries are dealing with the issues of fatality. The major issues is fall in the workplace. According to the statistical analysis of national construction casualties in 2012 (Figure 1), falling injury is 53.10% of total deaths in the construction industry, structure or temporary support the collapse is 14.43%, injury from objects is 10.57%, mechanical injury is 9.82%, and construction industry casualties from electric shock is 7.18%. More than 95% of all construction accidents are from these five categories (Zhao et al., 2006). However, falling injuries have the largest proportion of accidents.

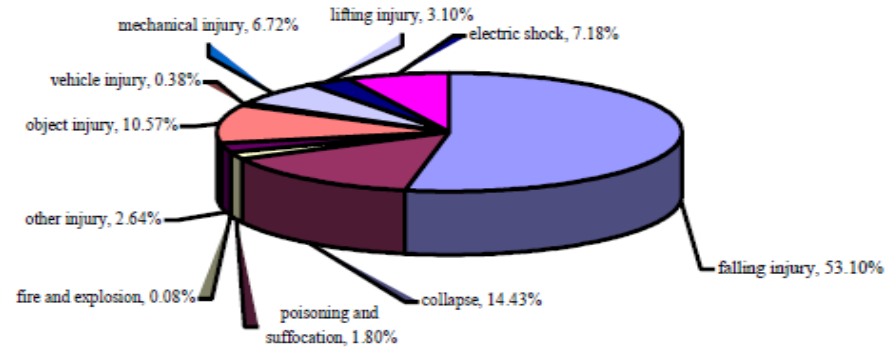


Figure 1.1: Construction Casualties Statistic.

Apart from that, Malaysian sector which causes the highest number of fatal. As can be seen from the figure (2), showing that the category of death unite as published by DOSH in 2008. The bar chat shows that the construction industry has the highest number of fatal victim with 67 victims. The Manufacturing sector come the next by 48 victims. The agriculture is come the third position with 46 victims.

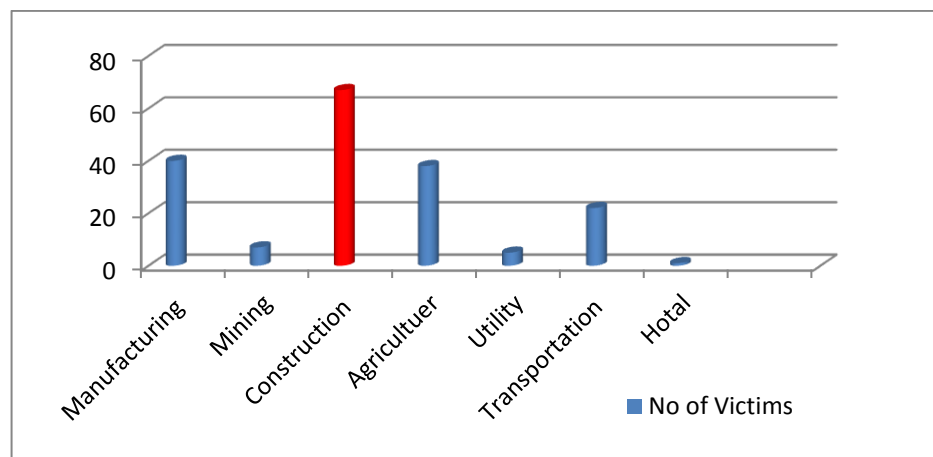


Figure 1.2: Category of Death Unit (Malaysia)

The study conducting by (Abdul Rahim Abdul Hamid et al., 2003) shows that the classification of fatal accident at the Malaysian construction industry. There are several reasons of fall in construction site such as, fall victim, falling objective, caughtine between, steeping on objective. Whereas, the highest number of victims

was by falling in construction site with 32%. The fall objective is the second highest causes of fatal by 26% followed by steeping on object with 25%.

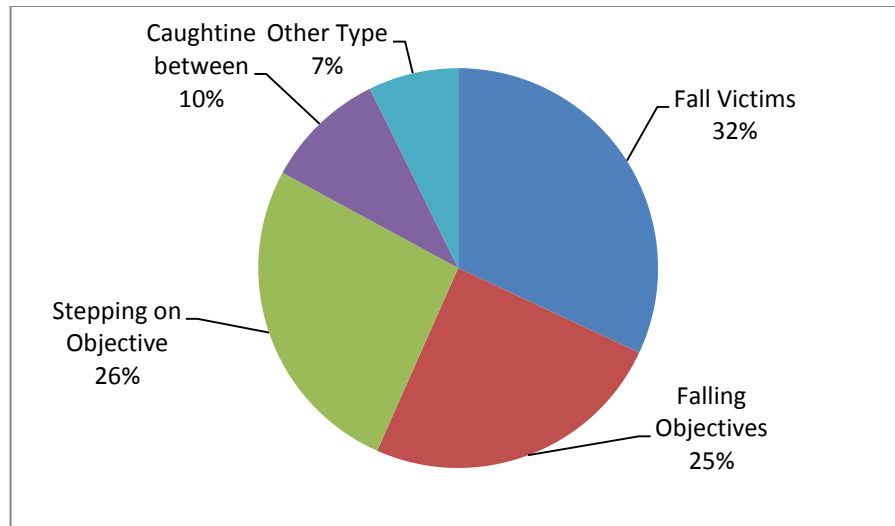


Figure 1.3: Frequency Type of Construction Accident

This research is aimed at identifying the causes of fall in construction site and factors affecting them. Then to propose procedures and control which will help to mitigate the current scenario of falling injuries in Malaysian building construction.

1.3 Objective of Study

The aim of this research is to propose way to reduce the incidents of fall in construction industry. To achieve the above aim, the following objectives have been identified:

- i. To study the causes of fall on construction site.
- ii. To study the factor affecting falls on construction site.
- iii. To find ways to reduce construction falls.

1.4 Scope of Study

The research is confined to building construction in Peninsular Malaysia. The research will be concentrated on studying causes and factor affecting fall in construction site. The questionnaire will be distributed to 50 targeted among project participant from different construction site in Peninsular Malaysia. Apart from that, face-to-face interview will be conducted to expert panels for collecting more information for this research.

1.5 Significance of Study

Most of people involved in construction industries were not take safety issues seriously. They are lack of awareness on safety and were not always beware in construction site. Construction sites are the most dangerous workplaces because of high incidence of accidents. We need to take safety first to preventive and avoid fatality.

The findings of this study are important to help people who involved in construction industry to understand on their own safety at construction site. The results of this research will help designers to consider hazards in their design so as to enhance the safety and health of construction workers in construction phase of projects.

1.6 Methodology of Study

Each research has a methodology in order to achieve its aim and objectives. The aim of this research is achieved through several stages which constitute the

methodology of the research. The following phases are not fixed and during the progress of research they may change.

Phase 1: Preliminary stage

Selection of the research topic is done through reading articles and journals, problem finding, determining the aim and objectives of the research and determination of the research scope constitutes the first phase of research.

Phase 2: Literature review

Previous literatures related to topic is reviewed. Secondary data consist of books, articles in journals and internet will be scrutinized to achieve an overview of the previous studies, researches, results and analysis.

Phase 3: Data collection

Besides collecting information from secondary data, the objectives of the research will be studied through primary data in third phase; predesigned questionnaires will be distributed and semi-structured interviews will be conducted for this reason. Safety professionals, managers and officers constitute the respondents of primary data collection in this phase of research.

Phase 4: Analysis and discussion

Analysis of data which have been collected in previous phases is will be performed; a summary of results will be prepared to conduct a discussion with expert panels to ensure the accuracy of results.

Phase 5: Conclusion and recommendation

Followed by analysis of data, the conclusion is made and based on conclusions recommendations and suggestions will be proposed.

REFERENCES

- Abdul Rahim Abdul Hamid, Wan Zulkifli Wan Yusuf, Bachan Singh, 2003, *Hazards at construction sites*, Proceedings of the 5th Asia-Pacific Structural Engineering and Construction Conference (APSEC 2003) 26-28 August 2003 Johor Bahru, MALAYSIA
- Cattledge GH, Hendricks S, Stanevich R. *Fatal occupational falls in the U.S. construction industry, 1980±1989*. *Accid Anal Prev* 1996;28:647±54.
- Chan, W.S.C., Wong, P.W.C., Chen, E.Y.H., Chan, S.S.M., Law, Y.W., & Yip, P.S.F. (2008). *Risk factors for suicide in adults aged 30-49: A psychological autopsy study in Hong Kong*. *BMC Public Health*, 8, 147
- Chi, C.F., Chang, T.C., Hung, K.H., 2004. *Significant industry-source of injury-accident type for occupational fatalities in Taiwan*. *Int. J. Ind. Ergon.* 34, 77-91.
- Chi, C.-F., Chen, C.-L., 2003. *Reanalyzing occupational fatality injuries in Taiwan with a model free approach*. *SafetySci.* 41, 681–700.

- Chi, C.-F., Wu, M.-L., 1997. *Fatal occupational injuries in Taiwan—relationship between fatalityrate and age*. *SafetySci*. 27, 1–17.
- Chia-Fen Chi, Tin-Chang Chang, and Hsin-I Ting, *Accident Patterns and Prevention Measures for Fatal Occupational Falls in The Construction Industry*, *Journal of Applied Ergonomics*, 2005, 391-400. Retrieve from www.elsevier.com, 15 July 2009.
- Department of Occupational Safety and Health, 2008, *Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC)*, Ministry of Human Resources, Malaysia
- Drury, C. G. and M. Brill 1983, *Human Factors in Consumer Product Accident Investigation* *Human Factors: The Journal of the Human Factors and Ergonomics Society* 25(3): 329-342.
- Frederick P. Rivara, MD, MPH, Diane C. Thompson, MS, 2000, *Prevention of Falls in the Construction Industry - Evidence for Program Effectiveness*.
- Geoff Taylor, Kellie Easter and Roy Hegney, 2004, *Enhancing Occupational Safety and Health*
- Health and Safety Executive (HSE) 2000. *Safety statistics bulletin 1999/2000*, London
- Hsiao. H., Simeonov, P., 2001, *Preventing falls from roofs: a critical review*, *Ergonomics*. 44:537–561.

- Huang, X., Hinze, J., 2003, *Analysis of Construction Worker Fall Accidents*. *J. Constr. Engrg. Mgmt.*, ASCE 129(3), 262-271.
- International Labour Organization, 2011, *Osh Management System: A Tool For Continual Improvement*, International Programme on Safety and Health at Work and the Environment (SafeWork)
- Janicak C. A., (1998). *Fall-related deaths in the construction industry*, *J Safety Res.* 29;35–42.
- Keyserling W. 1988, *Occupational safety: preventing accidents and overt trauma*. In: *Levy B, Wegman D, eds. Occupational health: recognizing and preventing work-related disease*. Boston: Little, Brown and Co., 1988:111±2.
- Kumuraswamy, M, and M. Dulaimi. 2001. *Empowering Innovative Improvements Through Creative Construction Procurement*, *Engineering, Construction and Architectural Management*. 8 (5/6): 325-334.
- Laflamme, L., Menckel, E., 1995. *Aging and occupational accidents: a review of the literature of the last three decades*. *SafetySci.* 21, 145–161.
- NIOSH [2000a]. *Comments of the National Institute for Occupational Safety and Health on the Department of Labor notice of proposed rulemaking and request for comments on child labor regulations, orders, and statements of interpretation: child labor violations—civil money penalties; 29 CFR Parts 570 and 579*. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, January 28, 2000.
- Phil Hughes and Ed Ferrett ,2007. *Introduction to Health and Safety in Construction (Second edition)*

- Singh, A., 2000. *Innovative fall protection for construction workers on low-rise roofs*. R. Coble, J. Hinze, and T. Haupt, eds., Construction safety and health management, Prentice-Hall, Upper Saddle River, N.J., 87–114.
- Sorock, G.S., Smith, E.O., Goldoft, M., 1993. *Fatal occupational injuries in the New Jersey construction industry, 1983–1989*. J. Occup. Med. 35, 916–921.
- Tariq S. Abdelhamid, John G. Everett (2000). *Identifying root causes of construction accidents*, Journal of Construction Engineering and Management, Vol. 126. No. I, January/February 2000, pp. 52-60
- Weeks JL, McVittie DJ. *Controlling injury hazards in construction*. Occup Med 1995;10:395± 405.
- Zhao, T.S., Li, X.R. and Deng, M. (2006). *“Safety Management about Construction Engineering.”* M. China Construction Press, Beijing.
- Zhou and Pang (2013), *“Study on Prevention Measures of Falling Accidents during Construction”*. ICPTT 2012 © ASCE 2013