

**ASSESSMENT OF SAFETY LEVEL  
IN PERFORMING  
BUILDING MAINTENANCE WORK IN MALAYSIA**

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For the very special.....

**My Family ;**

Ismail bin Awang & Rosma binti Md. Yasin,  
Ismawati, Ismaliana, Irwadi & Izwal

Thank you for everything.

The support and the love...

I will always love you all...

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Ever patient and always encouraging.

Your guidance has made me through....

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## **ABSTRACT**

Buildings are expected to exist for a long time, whether or not they are actually designed to achieve such longevity. The task of operating, maintaining and improving this stock of existing building is the responsibility of the building industry, as much as the production of new buildings. In many ways, it presents a more demanding safety consideration in performing the building maintenance work. Hence, in order to know more on safety consideration in performing building maintenance work, a survey is distributed among 100 building maintenance contractor in Kuala Lumpur, Selangor and Johor Bahru. The survey consists of general information and 28 safety factors relevant to contractor safety which were used to measure the contractor's safety attitude. Finally, the safety factors were ranked by their level of importance based on the survey result. In addition, the frequency rates and contractors safety attitudes determinants were used to measure the safety performance level for building maintenance contractors.

Keywords : building maintenance work, frequency rates, safety attitude score, safety performance level.

## **ABSTRAK**

Bangunan yang telah siap dibina akan wujud untuk jangka masa yang panjang. Industri pembinaan bukan sahaja bertanggungjawab untuk melakukan kerja-kerja pembangunan, penyelenggaraan dan peningkatan mutu bangunan-bangunan yang sedia ada, tetapi turut aktif dalam aktiviti membina bangunan-bangunan baru. Kawalan keselamatan yang lebih ketat harus dipertimbangkan dalam kerja-kerja pembangunan bagi memastikan tanggungjawab industri pembinaan terlaksana dengan sempurna. Satu tinjauan telah dilakukan yang telah diedarkan kepada 100 kontraktor penyelenggaraan bangunan dari Kuala Lumpur, Selangor dan Johor bagi mengkaji tahap keselamatan yang dipraktikkan oleh kontraktor-kontraktor ini dalam kerja-kerja penyelenggaraan bangunan. Tinjauan ini mengandungi maklumat am berkenaan kontraktor dan faktor-faktor keselamatan yang dipraktikkan oleh kontraktor. Hasil tinjauan digunakan untuk menilai prosedur keselamatan yang diamalkan oleh para kontraktor dan dianalisis serta disusun mengikut faktor yang tertinggi frekuensinya. Selain daripada itu, kadar kekerapan kemalangan dan amalan prosedur keselamatan juga digunakan sebagai penentu prestasi keselamatan yang diadaptasikan oleh para kontraktor ini.

Kata kunci : kerja-kerja penyelenggaraan bangunan, kadar kekerapan kemalangan, kadar prestasi keselamatan.

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## LIST OF SYMBOLS

$i$	=	Discount rate or rate of return used at that year
$h$	=	number of years or period of estimation

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## **CHAPTER 1**

### **THE NEED FOR ASSESSMENT OF SAFETY PERFORMANCE**

#### **1.1 Introduction**

During the 7<sup>th</sup> and 8<sup>th</sup> Malaysian Plan from 1996 to 2005 many building projects have been completed. Consequently it has now acquired relatively large and complex buildings both in the public and private sectors. Its complexity is evident in the high technology employed, and in the geographic spread of modern systems. Making full use of these facilities requires its efficient operation and introduction of sound safety maintenance practices.

Under the normal condition, buildings deteriorate. So, the task of maintaining, improving and adapting the stock of these existing buildings is the responsibility of the building industry, as much as the production of new buildings.

The need of maintenance is normally influenced by the climatic condition which is the effect of external condition (weather) to the building elements, effect by the user activity and effect by changing standard and tastes which create a demand for work to be carried out more frequently than functionally necessary. In many ways, it presents a more demanding safety consideration in performing building maintenance work.

Building contractor safety practices are important for many reasons (Nicole, 1988):

- Humanitarian reasons : Safety protects people's lives
- Government regulations: Most local authorities have safety laws and regulations of some kind. Typical safety regulations and fire codes are commonly issued and administered by the municipality and interior ministry or civil defense. Most of the regulations deal with the structural safety of buildings and with safety in construction and operations. These regulations govern the issue of building license or permit. Some of these regulations are (Brauer, 1990):

a. The fire department enforces the building designer to include safety requirements in the architectural design of the building so that maintenance work will have safer environment.

b. Government request contractor to develop and implement safety programs: there are many elements of a safety program that are essential to its success. Some are required by law and others vary with

the structure and operations of contractor organizations.

- c. Government emphasizes safety as a contractor responsibility and safety policy: a safety program must clearly identify who is responsible for what. Assignment of responsibility is normally a part of policy and procedures.
- d. Government enforces contractor commitment to safety: for safety to be an effective program there must be a commitment at the highest level. That commitment must include a clear statement that safety is important and support for actions that will make safety important.
- e. Government identifies hazards to be recognized and controlled: identification of hazards may be associated with new or modified operations, equipment or facilities. Inspections or periodic review of operating procedures will help identify hazards and whether controls for them are in place and in use. For example, there should be inspections of repair and maintenance work to ensure the guards are replaced or an area is clear of sources of heat and fire.
- f. Communicate with employees concerning their responsibilities for working safely: workers must learn about the hazards related to their job and the means for protecting themselves and how to perform particular safety procedures.

- Accidents affect public relations
- Accidents may affect operations
- Accidents cost money
- Productivity is increased with improved safety performance.

## **1.2 Statement of Problem**

Safety practices and regulations are important in the building maintenance industry. However, as in other types of industry, it is unknown to what extent contractors comply with safety practices and regulations. In addition, there is a lack of knowledge of variables that can be used to assess the safety level of building contractors.

According to industrial accident statistic from SOCSO, the rate of accident in Malaysia construction industry and building maintenance is 7.7:1000 in year 2004. The rate are still not satisfying and can be categorized as still high if compared to rate of accident in developed country such as Sweden, Japan, Korea and European Country which is 3:1000. Even though there have been a marked reduction in the number of industrial accident and the rate of accident per 1000 workers are declining from 15.4 in 1995 to 7.7 in 2004 since the introduction of OSHA 1994, but still there has not been a credible improvement over the last ten years. Although regulation in occupational safety and health in Malaysia are quite comprehensive, the level of awareness and practicability of such regulation within the society of construction industry generally lower than what supposed to come in force.



### **1.3 Aims and Objectives**

The aim of this study is to assess the safety performance level among building contractors in performing maintenance works. To achieve the above aim, the following objectives have been identified.

- (i) To determine the most important safety factors that affect the performance of building contractors.
- (ii) To measure the accident frequency rate and the safety attitude score for building contractors.
- (iii) To assess the safety performance level among building contractors.

### **1.4 The Significance of the Study**

This study was conducted mainly to find the most important safety factors that affect building contractors in carrying out their work. The results of this study will be very useful to enhance safety culture among building contractors in performing building maintenance works.

## **1.5 The Scope of the Study**

This research will be carried out with a careful study on data collection mainly on questionnaires survey exercise. This study will focus on building contractor in Kuala Lumpur, Selangor and Johor Bahru.

## REFERENCE

- Brauer, Roger L. (1990), "Safety and Health for Engineers", Van Nostrand Reinhold, New York.
- Crities, Thomas R. (1995), "Reconsidering The Costs and Benefits of a Formal Safety Program", Professional Safety, Vol.40, No.12, pp. 28-32.
- Dial, Cortneym. (1992), "Incident-Focused Managers", Professional Safety, Vol.37, No.4, pp. 37-45.
- Duff, A.R. and others (1994), "Improving Safety by the Modification Behavior", Construction Management and Economics, Vol.12, pp. 67-78.
- Eckhardt, Robert (1993), "Coordinating Regulatory Compliance Programs", Professional Safety, Vol.38, No.11, pp. 16-20.
- Friend, Mark A. (1992), "Financial Tools for Safety Manager", Professional Safety,

Vol.37, No.11, pp. 33-36.

Gallagher, Vincent A. (1993), "Safety of Outside Contractors", Professional Safety, Vol.38, No.1, pp. 29-33.

Geller, E. Scott (1995), "Safety Coaching", Professional Safety, Vol.40, No.7, pp. 16-22.

Geller, E. Scott (1995), "Ten Principles for Achieving a Total Safety Culture", Professional Safety, Vol.39, No.9, pp. 18-24.

Graham, H. (1979), "Operational efficiency and planning in maintenance work", in E.J. Gibson (ed), Development in Building Maintenance, London, Applied Science Publishers Ltd., pp. 1-36

Gregory, Earl D. (1991), "Motivational Management Techniques for Safety and Health", Professional Safety, Vol.36, No.1, pp. 29-34.

Grimaldi, John V and R.H. Simonds. (1989), Safety Management, Fifth Edition, Homewood, Boston, 1989.

Giustina, J. L.d. and Danier E.D. Giustina (1989), "Quality of Work Life Program Through Employee Motivation." Professional Safety, Vol.34, No.5, pp. 24-28.

Hinze, J., D. Bren and N. Piepho (1995), "Experience Modification Rating As Measure of Safety Performance." Journal of Construction Engineering and Management, Vol.121, No.4, pp. 455-458.

Jannadi, M. Osama, Sadi Assaf and Abdalla Al-Juaid (1994). "Assessment of Construction Project Safety in Saudi Arabia." Symposium on Safety in

Buildings and Prevention From Fires, King Faisal University, Dammam, Saudi Arabia.

Johnson, Stephen (1988), "Management Accountability for Safety Performance." Professional Safety, Vol.33, No.6, pp. 23-26.

Lee, R. (1976), "Building Maintenance Management", London, Crosby Lockwood Staples.

Levitt, R.E. and N.M Samelson (1981), "Improving Construction Safety Performance", The User's Role, Technical Report #260, Department of Civil Engineering, Standford University.

Longford, John C. (1984), "Conducting a Meaningful and Smooth Accident Investigation." Construction Newsletter, Nov.1984.

Mattila, M., E. Rantanen and M. Hyttinen (1994), "The Quality of Work Environment, Supervision and Safety in Building Construction." Safety Science, Vol.17, No.4, pp. 257-268.

Minter, G. Stephen (1993), "Building Safety Into Construction." Occupational Hazards, Sept. 1993.

Nicole, Dedobbeleer and Pearl German (1988), "Safety Practices in Construction Industry", Professional Safety, Vol.34, No.1, pp. 33-38.

Paul Wordsworth (2001), "Lee's Building Maintenance Management", Blackwell Science.

Petersen, Dan (1984), Techniques of Safety Management. McGraw Hill Co., New York, 1984.

Roughton, Jim (1993), "Protection for the Hazardous Waste Worker", Professional Safety, Vol.38, No.2, pp. 35-38.

Turek, Mark E. (1991), "Lockout/Tagout Maintenance Machines Safety", Professional Safety, Vol.40, No.12, pp. 24-27.

Ubaid, A.G. (1991), "Factors Affecting Contractor Performance." Master Thesis Presented to KFUPM, Dhahran, Saudi Arabia.

Weber, J. Own (1992), "The Front-line Supervisor's Role in Safety Professional." Professional Safety, Vol. 37, No.5, pp. 23-25.